

# JOURNAL

THE UNITED STATES ARMY  
MEDICAL DEPARTMENT

## WARRIORS IN TRANSITION HEALING WITH DIGNITY AND DETERMINATION

January - March 2008

<b>Perspective</b>	1
MG Russell J. Czerw	
<b>The Moral Imperative: Reflecting Back and Looking Forward</b>	5
BG Michael S. Tucker	
<b>The Comprehensive Care Plan: Building the Strength to Do Well Tomorrow</b>	8
LTC(P) Marie A. Dominguez, MC, USA	
<b>Ensuring Excellence: The Warrior Transition Unit Staff Training Program</b>	17
Sherri A. Emerich, MA	
<b>The Role of Occupational Therapy in Warrior Transition Units</b>	21
COL Mary W. Erickson, SP, USA	
<b>What Can Social Workers Do for Warriors in Transition?</b>	25
René J. Robichaux, PhD, LCSW; COL Nicole M. Keese, MS, USA	
<b>Facilities Maintenance: Uncovering the "Black Hole"</b>	27
MAJ Ricky Smith, USAR	
<b>Medical Care for Army Reserve and National Guard Soldiers in the Global War on Terror</b>	32
COL Susan Durham, AN, USA; COL Anne Bauer, AN, USA	
<b>The Brooke Army Medical Center Experience with a Focused Medication Reconciliation Program</b>	35
CPT Jesse W. Neeley, MC, USA; Sara J. Pastoor, MD, MHA	
<b>The Enhanced Reintegration Action Plan: The Madigan Experience</b>	38
LTC Karl Bolton, MS, USA; et al	
<b>Offering Hope for our Wounded Warriors: An Overview of the Womack Army Medical Center Pain Medicine Clinic</b>	45
MAJ Thomas Weber, MC, USA; MAJ Anthony Dragovich, MC, USA	
<b>ALSO IN THIS ISSUE</b>	
<b>The "Silent Killer": Hyperventilation in the Brain Injured</b>	50
LTC(P) Lorne H. Blackbourne, MC, USA; et al	
<b>Joseph Lister, Noncompressible Arterial Hemorrhage, and the Next Generation of "Tourniquets"?</b>	56
LTC(P) Lorne H. Blackbourne, MC, USA; et al	
<b>Maximizing Patient Thermoregulation in US Army Forward Surgical Teams</b>	60
LTC(P) Lorne H. Blackbourne, MC, USA; et al	
<b>Defining Combat Damage Control Surgery</b>	
LTC(P) Lorne H. Blackbourne, MC, USA	

20080627 031

THE UNITED STATES ARMY  
MEDICAL DEPARTMENT

A Professional Publication  
of the AMEDD Community

# JOURNAL

Online issues of the *AMEDD Journal* are available at [http://www.cs.amedd.army.mil/references\\_publications.aspx](http://www.cs.amedd.army.mil/references_publications.aspx)

January – March 2008

The Army Medical Department Center & School

PB 8-08-1/2/3

**LTG Eric B. Schoomaker**

The Surgeon General  
Commander, US Army Medical Command

**MG Russell J. Czerw**

Commander  
US Army Medical Department Center and School



**COL W. John Luciano, DC**

Dean, Academy of Health Sciences

**LTC Terrence E. Flynn, AN**

Chief, Department of Training Support, and  
Chief, Department of Academic Support and  
Quality Assurance

**Don Aldridge**

Editor

**Janet Aquino**

Assistant Editor

**Richard Burton**

Editorial Assistant

## EDITORIAL REVIEW BOARD

**COL Mustapha Debboun, MS, Chairman**

Chief, Medical Zoology Branch,  
Dept of Preventive Health Services  
AMEDD Center & School

**COL Ney M. Gore, MC**

Chief, Department of Soldier and Family Support  
William Beaumont Army Medical Center  
Fort Bliss, Texas

**COL Marc E. Mattix, VC**

Deputy Chief, Veterinary Corps  
Corps Specific Branch Proponency Officer

**COL Barry Moore, DC**

Chief, Department of Dental Science  
AMEDD Center & School

**COL Michael A. Pasquarella, MC**

Chief, Department of Medical Science  
AMEDD Center & School

**COL Patricia Patrician, AN**

Chief, Department of Nursing Science  
AMEDD Center & School

**MAJ Teresa Brininger, SP**

Research Occupational Therapist,  
USA Research Institute of Environmental Medicine

**COL Stephen C. Craig, MC**

AMEDD Consultant in Medical Corps History  
Professor, Uniformed Services University of the  
Health Sciences, Bethesda, MD

By Order of the Secretary of the Army:

Official:

JOYCE E. MORROW  
Administrative Assistant to the  
Secretary of the Army

GEORGE W. CASEY, JR  
General, United States Army  
Chief of Staff

DISTRIBUTION: Special

0801501

The *Army Medical Department Journal* (ISSN: 1524-0436) is prepared quarterly for The Surgeon General by the US Army Medical Department Center & School, ATTN: MCCS-HSA, 2250 Stanley Road Ste 0408, Fort Sam Houston, TX 78234-6150.

**CORRESPONDENCE:** Manuscripts, photographs, official unit requests to receive copies, and unit address changes or deletions should be sent to the *Journal* at the above address. Telephone: (210) 221-7326, DSN 471-7326.

**DISCLAIMER:** The *Journal* presents clinical and nonclinical professional information to expand knowledge of domestic & international military medical issues and technological advances; promote collaborative partnerships among Services, components, Corps, and specialties; convey clinical and health service support

information; and provide a peer-reviewed, high quality, print medium to encourage dialogue concerning healthcare initiatives.

Views expressed are those of the author(s) and do not necessarily reflect official US Army or US Army Medical Department positions, nor does the content change or supersede information in other Army Publications. The *Journal* reserves the right to edit all material submitted for publication.

**CONTENT:** Content of this publication is not copyrighted. Material may be reprinted if credit is given to the author(s).

**OFFICIAL DISTRIBUTION:** This publication is targeted to US Army Medical Department units and organizations, and other members of the medical community worldwide.

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p><b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b></p>					
1. REPORT DATE (DD-MM-YYYY) 01-03-2008		2. REPORT TYPE		3. DATES COVERED (From - To) January-March 2008	
4. TITLE AND SUBTITLE U.S. Army Medical Department Journal			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Don Aldridge, Editor			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Medical Department Center & School Department of Academic Support AMEDD Journal Fort sam Houston TX 78234-6160			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Department Center & School Bldg. 2840 Rm 106 2250 Stanley Road Fort Sam Houston TX 78234-6160			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; Distribution is unlimited.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Clinical and nonclinical professional information designed to keep U.S. Army Medical Department personnel informed of health care, research, and combat and doctrine development information.					
15. SUBJECT TERMS Medicine-Periodicals, Military Medicine-Periodicals					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT  Unlimited	18. NUMBER OF PAGES  72	19a. NAME OF RESPONSIBLE PERSON
a. REPORT  N/A	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER (Include area code) 210-221-6900

# Perspective

Major General Russell J. Czerw

A major shortcoming in the military's approach in caring for our critically ill or wounded Warriors, resulting from the Global War on Terror, was the lack of an established and supported organizational structure ensuring each Warrior is afforded the best possible opportunity to complete their mission: to heal and prosper in his or her life. Fortunately, a proven characteristic of the US military is the ability to quickly and efficiently organize, mobilize, and attack a problem in times of crisis. That strength became a major factor in addressing this need. The focus of this issue of the *Army Medical Department Journal* is the Army's multidimensional response to our obligation to those least able to speak for themselves—our Warriors who have paid a major price for their dedication and selfless service in defense of freedom and human dignity.

As BG Michael Tucker discusses in his excellent introductory article, even as immediate corrections were made to the more obvious problems, DoD rapidly put into motion a much larger and more complex effort. This undertaking had to encompass every aspect of care for those Warriors whose needs are extensive, complex, and long term. From his perspective as the first Assistant Surgeon General for Warrior Care and Transition, BG Tucker describes the reorientation of the Army's understanding of the dynamics of recovery to the perspective of the Warrior in Transition. No consideration remained unaddressed: physical environment, conveniences, Family participation, treatment, rehabilitation, life skills, and much more. An Armywide template was created; requirements, doctrine, and procedures established; resource needs identified and fulfilled; and training developed and delivered. Although the results to date have been impressive, as BG Tucker points out, there is still much to be done as there is always room for improvement. He finishes his article with descriptions of the ongoing proactive efforts and interagency initiatives across both military medicine and external resources.

The Warrior Transition Unit (WTU) is the foundation of the Army's efforts to address the needs of those Soldiers. LTC(P) Marie Dominguez presents a



thorough description of the organization, staffing, philosophy, and working relationships of the WTU. Her article details the procedures involved in the evaluation of a Warrior in Transition (WT) upon arrival at the WTU, the phases of the rehabilitation process as he or she progresses toward the ultimate goals, whether they involve continued military service or a new start in the civilian world. The road map for the Soldier's journey through the rehabilitation process is the Comprehensive Care Plan, the overall, personalized scheme created by the WT and the WTU cadre which defines all aspects of the Warrior's activities in the WTU. LTC(P) Dominguez's article provides an excellent insight into the thoroughness and attention to detail invested in the development and planning of the WTU model and the Care Plan, and the commitment by all of the dedicated professionals involved in the rehabilitation process.

Successful recovery and rehabilitation of WTs under the Army Medical Action Plan is directly dependent on the effectiveness of the WTU, which, by extension, means the effectiveness of the staff in performing their roles. As planning and development of the WTU structure evolved, the requirement for standardized training was formalized and delegated. In her article, Sherri Emerich describes the Army Medical Department Center and School's superb response to this extremely important tasking. In a remarkable

## Perspective

effort by the Academy of Health Sciences (AHS), the immediate need was filled in a very short time with 3 comprehensive distributed learning WTU orientation courses. The training experts then quickly turned their attention to the development of a resident course to ensure that the principal cadres of the WTUs are as well prepared for their responsibilities as possible. Also, to address training requirements before the first resident course convenes in October 2008, the AHS built and delivered a suite of courses to the WTUs for their local training purposes. The response by the AHS is yet another example of the teamwork and mobilization of resources to address a critical need that has long been the hallmark of Army medicine.

As described in an article in an earlier issue of the AMEDD Journal,\* occupational therapy has long been a recognized and respected part of the US military treatment regimen for recovering Warriors. Therefore, it is no surprise that occupational therapy (OT) is an integral component of the rehabilitative resources of the WTU. COL Mary Erickson's article is a detailed description of the goals and considerations driving the OT role in the WTU, and the various aspects of the professional and life skills and attitudes addressed by OT specialists who work with the WTs. COL Erickson makes it very clear how occupational therapy is such a vital element of the rehabilitation process. Indeed, restoration of the Soldier's confidence and competence is critical for him or her to regain the independence which is absolutely essential for a productive and fulfilling life in any environment. Our dedicated occupational therapy professionals work very hard to make this happen.

Whereas the occupational therapist's focus is on the WT's innate skills, abilities, and interests to restore self-confidence and a positive attitude about their own capabilities, the social worker's role is to assist the WT in his or her reintegration into the environment surrounding them. In their succinct, well-presented article, Dr René Robichaux and COL Nicole Keesee describe the social worker's approach to the WT's recovery process, and the contributions made in the overall rehabilitation program. It is extremely important that the social worker's insights and perspectives are included in development of the WT's Comprehensive Care Plan. Although the importance of healing

the WT's body and restoring his or her psyche and social skills is obvious, it is equally as important to accomplish that with a view toward the community outside of the isolation (and comfort) of the WTU's facilities, staff, and fellow WTs. This is why the social worker's early involvement in each WT's evaluation and Care Plan development is vital to his or her future, no matter the path followed after leaving the WTU.

Many factors contribute to an individual's overall attitude and opinion of self-worth. This becomes especially important when the individual is in a situation where he or she has very little control over the surrounding environment, as is the case of a military member recovering from serious injury or disease. Therefore, it follows that the physical environment within which our WTs live and work is an extremely important factor in their recovery. This priority has been communicated across the Army. Commanders of installations and medical facilities have committed tremendous time and resources to ensure that recovering Soldiers are housed and treated in the best environment we can offer. MAJ Ricky Smith's timely article addresses facility maintenance from the commander's perspective. He calls upon his many years of experience to provide insights for responsible officers who may be unfamiliar with the inner workings of maintenance management of buildings and other facility components. His information and recommendations should be extremely helpful in efforts to ensure our medical facilities, no matter the size and complexity, remain safe, clean, functional, and aesthetically acceptable. This is important not only to our WTs, but to our staff members and all other users of our facilities.

As we all know, the Global War on Terror involves large numbers of activated Army Reserve and National Guard Soldiers. Many of them have returned from combat theaters with serious injuries or lingering effects from disease or psychological stress. Others may be injured or become sick while on active duty, but not mobilized to a combat theater. In either case, the readiness of their units for future activations and deployments is directly affected by the physical readiness of every member. In their informative article, COL Susan Durham and COL Anne Bauer describe the two Army programs which were established to support the readiness posture of the Reserve and National Guard units by allowing their

\*Newton S. The growth of the profession of occupational therapy. *Army Med Dept J*. January-March 2007:51-58.

members access to military medical care while deactivated. The Medical Retention Processing 2 and the Active Duty Medical Extension programs are vehicles by which Reservists and National Guard Soldiers may apply for active duty status in order to receive the medical care necessary to return them to retention status and back to duty with their respective units as soon as possible. The Army Reserve and National Guard are increasingly important components to the defense of the United States, and therefore the health, welfare, and readiness of their Soldiers at all times is a major concern. These programs are important tools in maintaining the personnel readiness of these critical resources.

As a wounded or seriously ill Soldier moves from the battlefield through the medical care and support system, he or she receives care for different conditions from multiple providers at different locations. Therefore, it is not uncommon for a Warrior to arrive at the WTU with a "stock" of surplus medications, most of which are no longer required for the conditions, or which had been replaced in the Warrior's medication plan by other prescriptions. CPT Jesse Neeley and Dr Sara Pastoor have contributed an important article which gives us an insight into the scope of this problem. Their description of the medication reconciliation program implemented within the Brooke Army Medical Center's Warrior Transition Battalion highlights a situation which exists for every WTU in the Army. The importance of gaining control over the medication situation and plan for the individual WT cannot be overemphasized. As CPT Neeley and Dr Pastoor clearly demonstrate, medication reconciliation is vital to the health and safety of both the Warrior and the Family as they progress along the extended road to recovery.

Before the implementation of the Army Medical Action Plan in June 2007, the Army's medical treatment facilities and installations developed various programs and organizational structures at the local level to assist Warriors in Transition with their treatment and recovery. In their article, LTC Karl Bolton and his team describe one excellent example of initiative, creative thinking, and cooperation developed at the Madigan Army Medical Center and Fort Lewis. The Reintegration Action Plan (RAP) was developed to assist Warriors in the identification and pursuit of their goals, as well as to manage the

resources available to them. This program was initiated in January 2007 and was of major assistance in organizing and focusing the efforts of both the Warriors under treatment and the attending staff. The true measure of success of the RAP is the fact that it was upgraded and smoothly incorporated into the Army Medical Plan structure in the summer of 2007 as the Enhanced Reintegration Action Plan (ERAP). Indeed, as LTC Bolton et al describe, the RAP and ERAP provided the Madigan/Fort Lewis team a significant head start—a proven structure within which caregivers were experienced, comfortable, and overwhelmingly successful, thereby greatly assisting the implementation of the WTU and Comprehensive Care Plan at their installation. The ERAP is just another example of the initiative, creativity, and teamwork demonstrated by Army medical professionals in their untiring efforts to assist those entrusted into their care.

Unfortunately, one condition often attendant to recovery from traumatic injuries such as those suffered in combat is chronic pain, which sometimes continues long after recovery from the primary injury. In their excellent, informative article, MAJ Thomas Weber and MAJ Anthony Dragovich discuss the character of such pain and the problems it poses for practitioners who work to mitigate it. As would be expected, Warriors in Transition present a population with a significant number of complex patients with chronic pain due to difficult-to-treat conditions. The article describes the close working relationship between the Womack Army Medical Center's state-of-the-art interventional pain clinic and the Warrior Transition Battalion, and the various approaches to pain management for our WTs. Led by the Womack and Walter Reed Army Medical Centers, Army medicine is collaborating with the finest civilian medical research and educational institutions to address the many difficult issues associated with the treatment and management of chronic pain for our wounded and injured Warriors. These efforts are especially important to those providing care and assistance to the WTs, as chronic pain can result in depression and a sense of helplessness. Motivation and a positive outlook are essential for a successful recovery and transition. For many WTs, pain management is the first step in their personal Comprehensive Care Plan.

All of the articles discussed above focus on the vital care provided to Warriors at or near the end of a long

## Perspective

path of treatment that usually begins on the battlefield. Those multitasked medical professionals who save the lives of our wounded Warriors on the battlefield are only the first of many who will be involved in the Soldiers' treatment and recovery, but their skills and judgments make possible everything that follows. We close out this issue of the *AMEDD Journal* with four very important articles that address some of the most current concepts and experiences in traumatic wound care. LTC(P) Lorne Blackbourne of the Army's Institute of Surgical Research and his colleagues have been regular contributors to the *Journal*, and once again their well written, extensively researched articles demonstrate the level of professional expertise, initiative, and dedication that is the signature of Army medicine today.

The first article is particularly relevant to the Warrior in Transition focus of this issue. Traumatic brain injury often results in extended long-term care and rehabilitation. LTC(P) Blackbourne and his team describe the hazards of hyperventilation to those with severe brain injury, with detailed descriptions of the physiology involved. The article proposes changes to protocol and the use of relative simple technology to mitigate as much as possible the serious aftereffects of this serious injury. This article is must reading for those involved in providing early stage care to our seriously injured Warriors. It also should be carefully read by those involved in training those caregivers.

The tourniquet is one of the oldest battlefield treatment tools known to man. Military medicine is always looking to improve its effectiveness, ease of application, portability, etc. However, one limitation is its utility to control hemorrhage from those injuries to body areas which do not allow circumferential pressure. The second article looks into history and develops an innovative adaptation of an old concept, using a common workshop tool to demonstrate the potential to achieve compression where a standard tourniquet cannot. This is an interesting and ultimately practical approach to an age-old problem.

It has long been understood by those involved in trauma control surgery that hypothermia is a condition that has a deleterious affect on the patient. The third article delves into the complexities of hypothermia, examines statistical evidence of its importance to survivability, and explores various techniques and technologies to stabilize patient core body temperature. The article emphasizes the importance of managing hypothermia at the Forward Surgical Team level, as well as during helicopter transport. This is an important look at a situation that our combat deployed medical personnel experience every day.

The last article is an informative comparison of damage control surgery as practiced in the military and civilian environments. Civilian damage control surgery is a clearly defined process that is well understood by all involved in its application. On the other hand, combat damage control surgery is very difficult to define and quantify, primarily due to the dynamic conditions of the battlefield, the multiple transports required, and the various levels of stabilization, surgery, and care involved as the patient is moved through increasingly sophisticated facilities. LTC(P) Blackbourne's article is a clear, well-organized description of the complexities and consideration of damage control surgery as we must practice it, wherever and whenever our Warriors serve.

The cover picture emphatically summarizes the content of this issue. SSG Chris Pettaway can walk for himself in a 5 kilometer walk/run with his physical therapist, Mark Heniser (Center for the Intrepid, Brooke Army Medical Center) because battlefield medics and surgeons saved his life, dedicated medical caregivers worked to heal his wounds, and Warrior Transition professionals teamed with him as he continues to dedicate himself to accomplish his mission—*To Heal!* There is no compromise when the welfare of US Army Soldiers is concerned, whether on the battlefield, in the long-term aftermath of serious injury or disease, or anywhere else. They are the only reason that we are here.

# The Moral Imperative: Reflecting Back and Looking Forward

Brigadier General Michael S. Tucker

As we approached the one-year anniversary of the *Washington Post* article on Walter Reed, I was asked numerous times to reflect on all that we have accomplished over the past year. These accomplishments came about through a coordinated, compassionate, synchronized team effort. Just as it takes more than a single medic, physician, or nurse to heal a wounded, ill, or injured Warrior, it has required contributions from several Army staff agencies, as well as assistance from other federal, state, and private agencies to achieve the progress we have attained. We have made tremendous strides forward in the care and transition of Soldiers who have become wounded, ill, or injured in the line of duty, but there is still much work to be done.



BG Tucker, a career Armor officer, is the Assistant Surgeon General for Warrior Care and Transition, US Army Medical Command.

First, we as an Army very quickly understood that this was not a medical problem—it was an Army problem. We built and renovated barracks, yet we did nothing for the Medical Hold and Medical Holdover barracks; we fixed that by taking Soldiers out of barracks that were the worst on post and putting them in the best on post. We combined the separate and unequally supported Medical Hold (Active Army, commanded and controlled by the Medical Command) and Medical Holdover (Reserve Component, commanded and controlled by the installation management command) into a single Warrior Transition Unit under the Medical Command and provided it with an approved Table of Distribution and Allowances.\* Where we had less than 400 untrained cadre members, we now have 2463 trained and certified cadre and staff. We have hired an additional 26 doctors, an additional 157 nurse case managers, 72 social workers, 7 occupational therapists, and 13 occupational therapy technicians.

We resisted a culture of “haves” and “have-nots” by avoiding the separation of care into categories that would imply one Soldier was more deserving than another (Soldiers with combat wounds versus Soldiers

with disease or nonbattle injury; seriously injured or ill versus not seriously injured or ill). We recognized that the Soldier who sustained an amputation in a tactical vehicle accident in training was just as deserving as the Soldier who sustained an amputation in a vehicle accident in Iraq, who was just as deserving as the Soldier who sustained an amputation in a combat attack. We recognized that the Soldier that developed an illness in combat was no less deserving than the Soldier who sustained a shrapnel injury.

We recognized that it was not just the Soldier who had suffered a loss, but the Family as well, and we improved the support we provide Families. We gained authorization to transport wounded, ill, and injured Soldiers and their Families in government vehicles. We now meet Family members arriving on invitational travel orders at the airport. We established Soldier and Family Assistance Centers so Soldiers and Families can get support in a single location without having to

\*Prescribes the organizational structure, personnel and equipment authorizations, and requirements of a military unit to perform a specific mission for which there is no appropriate table of organization and equipment.

## The Moral Imperative: Reflecting Back and Looking Forward

negotiate a strange post to find a dozen different places. These centers offer one-stop access to essential services such as pay, legal, health benefits, and housing. We removed bureaucratic barriers to assigning nonfamily members as nonmedical attendants. We authorized single Soldiers with nonmedical attendants to live in family housing. We produced a video to orient Family members of severely injured Service Members to their “new normal,” helping them to understand the challenging road of recovery that they face.

We worked to improve the Physical Disability Evaluation System (PDES) within the constraints of current law. We gave Soldiers electronic access to monitor the status of their Medical Evaluation Board and Physical Evaluation Board through their Army Knowledge Online accounts. We reduced the number of forms required for a Medical Evaluation Board. We are conducting a triservice PDES pilot in the National Capitol Area that provides for a single physical exam and gives the Soldier both VA and Army ratings prior to separation from the Service, allowing him or her to more expeditiously apply for VA benefits and healthcare. We improved the ratio of Physical Evaluation Board liaisons (PEBLOs) and Medical Evaluation Board physicians. We standardized the training for the PEBLOs and certified them.

We have recognized concussive injury and post traumatic stress as particular challenges, and have made improvements in our culture towards the acceptance of treatment for mental health disorders without incurring stigma. We have begun baseline cognitive screening of Service Members before they deploy to a combat zone, screen for exposures and symptoms while they are in the combat zone, and screen for symptoms upon return. We produced a chain-teach\* video on the recognition of symptoms that could be consistent with traumatic brain injury or post traumatic stress disorder. We produced a second version to be viewed by Family members.

We have recognized that Warriors in Transition have a mission—*To Heal!* And everything they do during

their duty day must support that mission. To promote healing, we have restricted access to alcohol. We have recognized that many of our Warriors in Transition need mentorship and guidance, and therefore we are training all of our squad leaders to be life coaches who will encourage them in the accomplishment of their goals and objectives as they progress through their personal Comprehensive Care Plan. The Plan requires the Warrior in Transition to spend their 9-hour duty day decisively engaged in activities that promote their healing—medical appointments, classes, group therapy, therapeutic exercises and activities, vocational training, or educational activity. In this effort we have partnered with several institutions of higher learning to enable Warriors in Transition to achieve their personal education goals.

We provided commanders with the tools required to address the needs of their Warriors in Transition with an ombudsman and a Wounded Soldier and Family Hot-Line number (1-800-984-8523). In addition, we provided the commanders with tools that would enable them to see themselves with a Warrior Transition Unit Status Report and Quarterly Training Brief.

While it is personally satisfying to consider our accomplishments, we will not continue to move forward if we lose sight of what we still must do. We have made tremendous progress in the last year, but we cannot rest on our laurels. There is still much to accomplish. We must continue to push forward.

There are things yet to be shaped within the Army’s battle space. We must continue to refine our management of high risk Warriors in Transition, particularly with respect to mind- and consciousness-altering medications. We must continue to make improvements in our culture so that Soldiers understand that they can ask for help without perceived detriment to their career.

We must continue to develop digital solutions. In particular we must fully automate our profile system to improve the communication between doctors and commanders. We must improve the consistency of documenting all deployed traumatic events, military acute concussion evaluations, and deployed healthcare in the theater AHLTA\* application, thereby improving our health data record for post-deployment treatment and, if needed, for the physical disability evaluation.

---

\*Chain-teach is a method of unit training in which designated unit members first receive the training, after which it is their responsibility to train another level of personnel, who in turn will continue training others. The training continues in a pyramid fashion until all personnel requiring such training have received it.

---

\*The US military electronic medical record

## THE ARMY MEDICAL DEPARTMENT JOURNAL

We must continue to refine the diagnosis and treatment of concussive injury (also called mild traumatic brain injury) and post traumatic stress disorder. We must continue to refine and fully implement our Comprehensive Care Plan policy, and reassess our staffing models to ensure we have the appropriate staff to perform the required work.

We must optimize our relationship with the Department of Veterans Affairs (VA) so that every Soldier transitioning out of the military is enrolled with the Veterans Health Administration, and, where appropriate, has a prearranged appointment with their VA provider. In addition, we must cooperate with the Veterans Benefits Administration to ensure all Warriors in Transition submit their application for VA benefits prior to their separation. We must continue efforts with the VA to modernize and improve the physical disability evaluation system.

We still must develop a single resource identifying nongovernmental and veterans service organizations that provide benefits to Soldiers. We continue to struggle with the coordination of matching organizations wishing to offer jobs to Veterans with Soldiers who wish to interview for those jobs.

While we remain vigilant in our cause, we will continue to foster relationships with the VA, sister services, veteran's service organizations, and other intragovernment agencies. Our efforts at transparency and keeping Congress informed has forged a new trust and confidence which must be preserved. Finally, the momentum must be maintained and, as we have from the beginning, we must continue to make decisions based on what best supports the healing of our Warriors in Transition and their Families.



# ***The Comprehensive Care Plan: Building the Strength to Do Well Tomorrow***

LTC(P) Marie A. Dominguez, MC, USA

## **OVERVIEW**

The Army established the Warrior Transition Units (WTUs) for Soldiers requiring ongoing, time-intensive, medical, surgical, or psychiatric treatment. The WTU sets the conditions and establishes a framework for healing to enable the Soldier to regain function and productivity. Soldiers assigned or attached to a WTU are called Warriors in Transition (WTs), because they are at a transition point; their lives have been changed by injury or illness and they are working to recover and return to duty or return to life as a vocationally enabled Veteran. The Comprehensive Care Plan utilizes a holistic approach; the WT is encouraged to set goals for healing within 4 life domains: physical (body), mental (mind), social (heart), and spiritual (spirit). The holistic approach is based on the following principles:

- Be responsible for one's own future
- Gain more control over one's life
- Promote health and sense of well-being
- Maintain a positive self identity
- Shape satisfying social relationships
- Overcome social and cultural barriers

When a person's body or mind suffers illness or injury, the heart and spirit are often affected. To fully implement a Comprehensive Care Plan, attention must be given to all 4 life domains. Family members, care givers, and significant others play an integral role in WT rehabilitation; therefore, it is important to encourage their participation in all levels of care. For WTs who are geographically separated from their Family members or significant others, this may involve the inclusion of Family members or significant others in meetings, use of video or telephone conferencing.

To achieve the principles of holistic healing, it is imperative that WTs spend their duty days gainfully

engaged in purposeful activities that promote healing in all 4 life domains. To promote a sense of responsibility and control, every WT (with aid and guidance from an integrated WTU team) will develop a Comprehensive Care Plan that addresses all 4 life domains, and is goal directed and milestone driven. Goals and milestones must be measurable and have a timeline for attainment. The WTU triad (primary care manager, nurse case manager, and squad leader) and the WT must set a target transition date. To facilitate the Comprehensive Care Plan, the WT (with guidance and encouragement from the WTU cadre, clinical staff, and support staff) must develop a long-term, weekly, and daily WT training calendar that accounts for medical appointments and other activities related to healing. A standard duty day is 9 hours. All WTs must spend their duty day decisively engaged in activities designed to promote healing which may include:

- Medical and rehabilitation appointments, classes, or activities
- Cognitively enhancing activities (ie, military education distance learning courses, college courses, foreign language study)
- Vocational training or enhancement program (ie, duty in a unit in a military occupational specialty for which the WT is qualified, or hopes to qualify for, on-the-job training or internship program designed to complement the WT's vocational interests and further enhance vocational skills)

Upon completion of the WT's tenure in the WTU, the WT will:

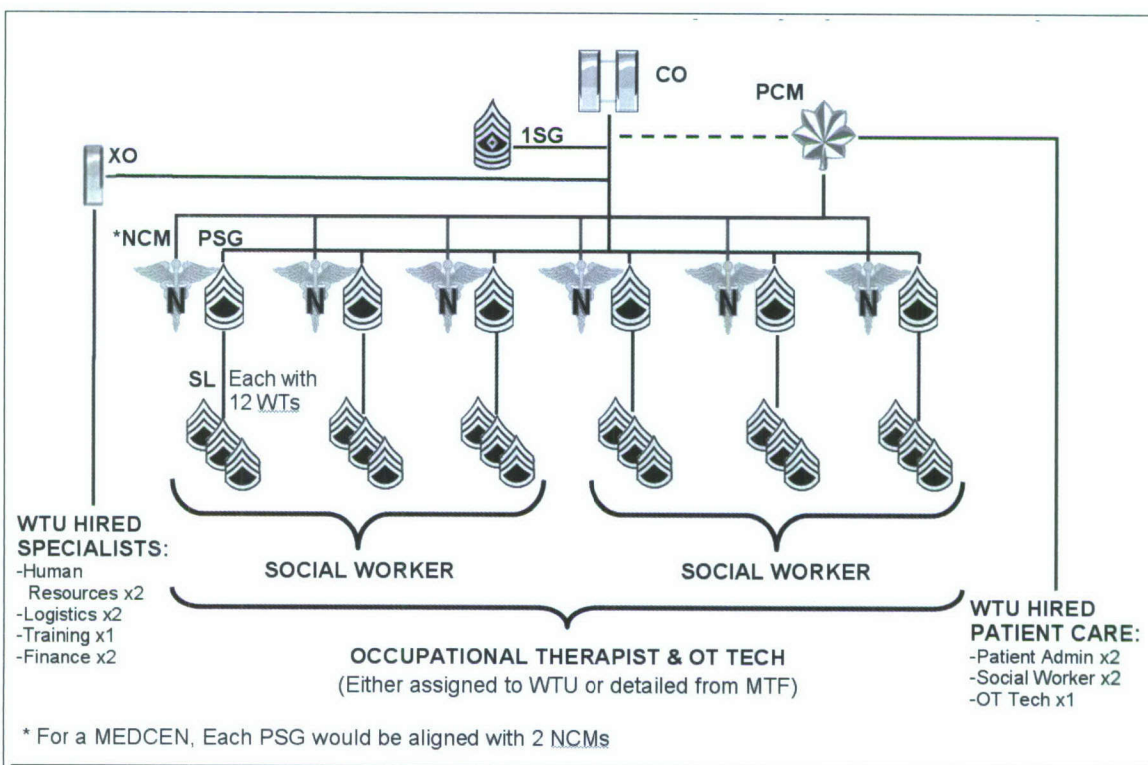
- Be physically, mentally, socially, and spiritually strengthened
- Be vocationally enabled to the maximum extent possible and/or have life-care plans in place
- Be equipped with the tools to maintain personal and professional relationships
- Be proud of their service to the nation

## THE TEAM CONCEPT

The Warrior in Transition is at the center of the Comprehensive Care Plan and is the central team member. Early in the development of the Warrior Transition Unit, the term “triad” of support was coined. The WTU triad consists of the WT’s primary care manager, nurse case manager, and squad leader. With support from other key staff, the WTU triad provides critical longitudinal and conceptual integration of the Comprehensive Care Plan and supports the Warrior in Transition. To gain synergy from the integration of medical management and command and control, key cadre and support staff must be aligned into habitual team relationships as illustrated in the Figure. A squad leader should interact with a single nurse case manager (due to increased nurse case manager staffing at medical treatment facilities, one squad leader may need to interact with 2 nurse case managers). The nurse case manager

interacts with one primary care manager, one social worker, and one occupational therapist.

The company commander guides and directs the leadership, administrative, and support processes. The primary care manager guides and directs the medical treatment and clinical support plan. The nurse case manager oversees the implementation and coordination of the medical treatment and clinical support. The platoon sergeant and squad leader serve as mentors and life coaches. In addition, they are responsible for daily implementation of leadership and coordination for administrative support. To be successful, the WTU triad relies on a host of other clinical and installation support staff to fully promote healing. Two key members of the team are the social worker who assists with the evaluation for and coordination of social and community support services, and the occupational therapist who assists with the evaluation of the WT for vocational interests



Team Organization of a standard Warrior Transition Unit Company serving 216 Warriors in Transition.

### Glossary

CO	Commanding officer	XO	Executive officer
1SG	First sergeant	PCM	Primary care manager
NCM	Nurse case manager	PSG	Platoon sergeant
SL	Squad leader	WTs	Warriors in Transition
WTU	Warrior Transition Unit	OT	Occupational therapy
MTF	Medical treatment facility (military)	MEDCEN	Medical center (military)

## The Comprehensive Care Plan: Building the Strength to Do Well Tomorrow

and capabilities, and the coordination of purposeful activities in the vocational or educational realm.

### TEAM COMMUNICATION AND COORDINATION

Communication and coordination are essential to effective team function. There are recurring communication episodes that occur between various team members. The squad leader and the WT interact on a daily basis to continually assess for obstacles.

**Formations.** Warrior Transition Units may require their Warriors in Transition to attend formations. Formations are an efficient and effective means of accounting for Soldiers, communicating command and general information, developing team identification, maintaining Soldier standards, and assessing the interactions of WTs with peers and supervisors. When planning formations, WTU leadership must consider mobility limitations of their WTs.

**Daily Squad Leader–WT interaction.** The SL will have interaction with each WT in his or her squad every duty day to assess potential problems, gauge the WT's well-being, provide mentorship and guidance, and monitor progress with the Comprehensive Care Plan goals and milestones. If the commander or the WTU triad determines that a WT is at high risk for suicide, medication error, or other risk to life or health, the squad leader or his clearly designated representative (such as a staff duty noncommissioned officer) is required to make nonduty day contact with the WT for a well-being assessment.

**Weekly Nurse Case Manager–WT interaction.** The nurse case manager will meet with the WT at least once weekly to assess for problems, gauge the WT's well-being, provide mentorship and guidance, and monitor progress with the Comprehensive Care Plan goals and milestones.

**The WTU Triad Meeting.** The WT, the primary care manager, the nurse case manager, the squad leader, Family members (or significant others) and other team members (as appropriate) will gather occasionally to develop, define, and assess goals. At a minimum, a full WTU triad meeting is held during the goal-setting phase and at decision points. WTU triad meetings may be called at other times as necessary.

**WTU Triad Synchronization Meeting.** It is imperative that the WTU triad and supporting healthcare and support services function as a team. To facilitate such

teamwork, it is suggested that weekly synchronization meetings be held to achieve synergy between the medical management and command and control elements. Unfortunately many WTUs are using these valuable opportunities primarily as meetings to gauge the progress of the Medical Evaluation Board (MEB), and, in many places, the WTU commander or the primary care manager is not present. With MEB duration as the main yardstick and indicator of whether to present a WT or not, the team is not focused on the most at-risk Soldiers. Instead of MEB duration, I recommend the nurse case manager and platoon sergeant present updates on WTs who are new (in the reception phase), in the final transition phase, in recovery (very ill or debilitated), at a decision point, or any other WT about whom they have concerns. The commander can then provide guidance on leadership, administrative, and support issues, and the primary care manager can provide guidance on clinical care and coordination, thus achieving synergy from combining command and control with medical management.

The WTs are not present and these meetings are not meant to be in-depth reviews or coordination efforts. If the team finds itself spending more than two or three minutes discussing a Soldier, it is an indication that a separate WTU triad meeting dedicated to that WT is required. Ideally the meeting will last one, or at most 2 hours. During the initial 50 minutes (90 minutes for a 2-hour meeting), the nurse case managers and platoon sergeants present progress and issues encountered by their WTs. Other staff with training in the Health Insurance Portability and Accountability Act<sup>1</sup> (HIPAA) also attend the synchronization meetings and provide input as necessary. The last 10 to 30 minutes are reserved for non-HIPAA trained personnel to join and have an opportunity to bring their observations and concerns to the WTU triad. These individuals remain available after the meetings to facilitate one-on-one coordination efforts.

### PHASES OF THE REHABILITATION PROCESS

The rehabilitation process is divided into 6 contiguous phases with boundaries that often overlap, eg, medical assessments may begin while the Soldier is still officially in the reception phase. Assessments for Family assistance and support and referrals for nonmedical benefits and services will occur throughout all phases of the rehabilitation process.

## Reception Phase

During the reception phase, the cadre and the designated Battle Buddy\* welcome and orient the new WT to the WTU. The cadre introduce themselves, complete initial intake interviews, and assess the WT for risks related to his medical condition, mental health, mobility limitations, cognitive abilities, medications and other drugs. The risk assessment is used to determine the WT's housing assignment and urgent medical and behavior health appointments. During this phase, the WT completes administrative and financial inprocessing. The cadre members orient the WT to his or her rights and responsibilities and set expectations (initial counseling), orient the WT to the goal-setting concept, and introduce the concept of the WT training calendar. With guidance from the cadre, the WT will develop, update, and maintain a personal training calendar which is reviewed at nurse case manager and squad leader meetings.

## Initial Assessment Phase

During this phase the WT, WTU triad, and other healthcare professionals assess the current condition, abilities, and capabilities in the domains of body, mind, heart, and spirit. As shown in Table 1, the assessment phase includes an appraisal of the WT's level of function, need for services (medical, surgical, behavioral health, and community), Family needs, vocational and educational goals, abilities, self-care capability, and lifestyle. Army Community Service now provides a career assessment tool that will assist the WT in determining his or her interests. Assessments are made in the 4 life domains and tailored to the needs of the WT.

It is important to note that assessment of the WT does not stop at the end of this phase. This phase allows an in-depth initial assessment. Continued reassessments occur throughout the remainder of the rehabilitation process. General assessments are made with each squad leader and nurse case manager meeting. Specific assessments are made along the timeline for goal and milestone achievement.

---

\*Defined as the person to whom the WT can turn in time of need, stress, emotional highs and lows, that will not turn the WT away, no matter what. This person knows exactly what the WT is experiencing because he or she is currently going through a similar experience or has been through a similar experience and/or situation before.

## Goal-Setting Phase

Many WTs will begin to formulate ideas about their goals and objectives as they progress through the assessment phase and may have already started working towards those goals. The WT, WTU triad, and Family (if available) will meet and the WT will formally set his or her goals, with intermediate objectives, a timeline, and a defined plan to achieve them. Consideration should be given whether to focus on skills for a successful return to duty, or skills for a transition to a healthy, successful Veteran. The cadre members guide the WT in the development of goals with a focus on healing and the development of positive life-skills and habits, for improvement in body, mind, heart, and spirit. Depending on needs, the WT may establish goals in the areas of functional independence and mobility, community mobility (transportation), return to duty, and other vocational skills, education, social interaction, leisure, and recreation. Injury or illness is particularly stressful to relationships, therefore, all WTs are encouraged to develop goals with relationship enhancement in mind. Documenting the WT's goals, objectives, timeline, and plan in the electronic medical record (AHLTA) facilitates communication among caregivers and enables them to reinforce the plan.

## Active Rehabilitation Phase

During this phase, WTs place activities on the training calendars that will assist them in accomplishing the goals and objectives each has set for him or herself. Family members and caregivers are actively encouraged to participate as full partners in the process, along with ancillary healthcare professionals and support staff. During their scheduled meetings with the WT, the squad leader and nurse case manager provide encouragement and oversight in monitoring the achievement of milestones on the training calendar. This phase is divided into 4 tiers:

**Tier A: Recovery.** Recovery may interrupt any phase of the rehabilitation process, but it does not send the WT back into any phase. Of course, a reassessment of the goals and objectives is warranted after recovery. WTs are placed in recovery only if they are unable to participate in any physical, mental, relationship, or spiritual strengthening programs. This is an unusual situation for an outpatient setting, but some WTs may be placed in Tier A for short periods in the immediate

## The Comprehensive Care Plan: Building the Strength to Do Well Tomorrow

postoperative period, or during profoundly debilitating therapy, such as chemotherapy.

**Tier B: Basic Reset.** The WT spends the entire training day performing activities related to therapeutic rehabilitation. He or she is actively engaged in medical and therapeutic appointments; group and/or individual therapy; and strengthening, range of motion, or endurance exercises at the gym or pool. In addition to specific therapeutic regimens, all WTs complete a basic “reset” curriculum containing the following programs of instruction:

- Transition rights and responsibilities
- Post traumatic stress disorder/traumatic brain injury chain-teach\* program
- Goal planning
- Maintaining healthy relationships
- Managing stress and energy
- Communication skills
- Maintaining a healthy weight and nutrition status (including medication effects) while recovering from injury or illness
- Managing/reestablishing cardiovascular fitness
- Conflict resolution
- Battle Buddy skills
- Financial benefits overview and basic money management

\*Chain-teach is a method of unit training in which designated unit members first receive the training, after which it is their responsibility to train another level of personnel, who in turn will continue training others. The training continues in a pyramid fashion until all personnel requiring such training have received it.

Table 1. Initial assessment of the Warrior in Transition normally includes the following areas addressed across the 4 functional domains.

<b>Body (physical)</b>		
Medical evaluations	Aerobic condition	Functional assessment
Surgical evaluations	Balance	Activities of Daily Living (ADLs)
Psychiatric evaluations	Muscular strength	Instrumental ADLs
Pain assessment	Fine and gross motor skills	Mobility
Physical abilities and limitations, including profile limitations	Range of motion	Transportation (commuting and driving)
	Body fat & nutrition assessment	Addictions and misuse of substances
		Quality of sleep
<b>Mind (cognitive/vocational/emotional)</b>		
Vocational education status	Concentration skills	Screening for traumatic brain injury and post traumatic stress disorder
Interests/assessments	Attitude and motivation	Language skills
Psychological testing	Financial situation and skills	Speech, hearing, reading, writing
Cognitive assessments	Leisure time management	
<b>Heart (social)</b>		
Interpersonal/ relationship skills	Communication skills	Socially acceptable behavior
Support systems	Conflict resolution	Current/future living arrangements
Family dynamics/status	Anger management	Unit of assignment
Parenting	Intimacy	
<b>Spirit</b>		
Motivation: values, beliefs, goals	Avocational pursuits	Community service, volunteer activities—ways to contribute to the community, both now and in the future
What provides meaning and purpose to the WT's life	Recreation, sports, hobbies, music, art, and leisure—activities that add joy and depth to the WT's life	
Support systems		
Religious/Cultural Support		

## THE ARMY MEDICAL DEPARTMENT JOURNAL

- Educational benefits overview and career development
- Understanding medications, safety, and avoiding addictions
- Basic relaxation techniques and sleep hygiene skills
- Time management skills
- Locations with Army Center for Enhanced Performance\* (ACEP) facilities will incorporate the full ACEP curriculum into their basic reset curriculum.
- Functional activities
- Warrior basic skill training and return to duty skills
- Military occupational specialty training
- Specific problem solving and goal setting
- Specific financial management skills training
- Specific leisure/time management skills training
- Work readiness skills (work habits, values, interests, work skills, vocational exploration)

**Tier C: Intermediate Reset.** WT's spend part of their duty day in vocational or educational activities, but still dedicate a significant portion of their duty day to activities specifically designed to rehabilitate their body, mind, heart, and spirit. Tier C will generally involve interventions targeted at addressing a specific goal. Advanced training and intervention to address individualized needs may be provided by various medical specialists, including:

- Occupational therapy
- Physical therapy
- Social work
- Chaplain
- Soldier and Family assistance center
- Army Center for Enhanced Performance
- Education center
- Unit mentors (a Soldier that is part of a unit on post that supervises the WT in a return to duty skill such as a new military occupational specialty)

Topics may include:

- Anger management
- Assertiveness/communication skills
- Specific nutrition and/or weight management
- Physical training
- Specific life-skills
- Targeted relationship coaching

**Tier D: Life Reset.** Generally these WT's have completed their Medical Evaluation Boards and are awaiting the findings of the Physical Evaluation Boards, or are preparing for return to duty. They spend the majority of their duty day in vocational or educational activities, but may still require ongoing medical treatment or rehabilitation. For many WT's, their work assignment will be compatible with established goals and within the confines of their physical profile. An additional aspect of this phase is an increased emphasis on Family and community reintegration.

### Final Transition Preparation Phase

The phase begins when the Soldier knows whether he or she will return to duty or separate (or retire) from the service. The WT and significant Family member(s) are given up to 90 days to prepare for return to duty or transition to life as a Veteran. WT's found fit for duty must complete the necessary administrative tasks prior to transfer to their next duty station. For the WT returning to civilian life, final preparations must be made to ensure a successful transition to Veteran status and civilian life, with the Veteran fully integrated into the community.

WT's returning to duty will complete the following tasks:

- Army physical fitness test
- Update security clearance
- Update ORB/ERB<sup>†</sup>

\*The Center for Enhanced Performance is a department of the US Military Academy Preparatory School, West Point, New York. Information is available at [http://www.usma.edu/USMAPS/pages/academics/cep\\_home.htm](http://www.usma.edu/USMAPS/pages/academics/cep_home.htm).

†The ORB (Officer Record Brief) and ERB (Enlisted Record Brief) are one page Army forms designed to provide a summary of the Soldier's qualifications and career history. The ORB and ERB are produced from data stored in the Soldier's Master File at the Army Personnel Center.<sup>2</sup>

## The Comprehensive Care Plan: Building the Strength to Do Well Tomorrow

- Update official photo
- Discuss future assignments with branch manager
- Arrange to ship household goods and/or vehicles
- Arrangements for required durable medical equipment
- Identification of a post-transition contact phone number

WTs transitioning to Veteran status will make the final preparations, which can include, but are not limited to:

- Applying for federal and state veteran's benefits, including disability
- Enrollment in the Veteran's Health Administration (VHA) and identification of a VHA treatment facility near the Veteran's desired home to include an initial appointment and identification of a Department of Veterans Affairs (VA) case manager
- Application for social security benefits if indicated
- Application and acceptance to educational institutions
- Development of employment opportunities for the Veteran and the Family member
- Arrangements for housing to include adaptive modifications
- Healthcare enrollment for the Veteran and the Family
- Transfer Servicemembers' Group Life Insurance\* to Veterans' Group Life Insurance\* or other arrangements for life insurance
- Arranging school transfers for children
- Arrangements for required durable medical equipment
- Identification of a post-transition contact phone number
- Ensure that all paper records have been scanned into the Soldier's electronic medical record

- Ensure WT is provided with a copy of his medical records

### Transition/Post-Transition Phase

During this phase the WT completes administrative and financial out-processing and confirms the arrangements for the WT's post-transition life. Thirty days after the Soldier leaves the WTU, the nurse case manager conducts a post-transition telephone survey to assess how well the WT was prepared for the transition. If the WT identifies problems, the nurse case manager will coordinate with the VA or other appropriate entity to resolve the problem.

### DECISION POINTS

Decision points should not be confused with progress assessments which are guided by the goals and milestones that the WT set during the goal-setting phase. Decision points are specific points on the timeline where the WTU triad, in consultation with the Soldier and the multidisciplinary team, formally assess the Soldier's return to duty potential and document the assessment in his/her electronic medical record. These return to duty assessments are conducted every 3 months, with the first decision point at 3 months after initial assignment or attachment to the WTU.

**At 3 months** after assignment (or attachment) to the WTU, the WTU triad will hold a formal meeting with the WT and Family with the focus on the question, "Has the Soldier's condition and function improved sufficiently to meet retention standards in accordance with the Army's *Standards of Medical Fitness*?<sup>3</sup>" If the answer is yes, appropriate steps to return the Soldier to duty, either in the same or a new military occupational specialty, should be pursued. If the answer is no, the WTU triad and Soldier must decide whether to continue treatment and rehabilitation in the WTU, or to prepare for ongoing treatment and rehabilitation as a Veteran.

**At 6 months**, the WTU triad holds a meeting with the WT and Family with the focus on the question, "Has the Soldier's condition and function improved

---

\*Servicemembers' Group Life Insurance (SGLI) is a program of low cost group life insurance for service members on active duty, ready reservists, and members of the National Guard. Veterans' Group Life Insurance (VGLI) is a program of post-separation insurance which allows service members to convert their SGLI coverage to renewable term insurance. Members with full-time SGLI coverage are eligible for VGLI upon release from service. Source: VA website, available at <http://www.insurance.va.gov/sgisite/SGLI/SGLI.htm>

sufficiently to meet retention standards in accordance with the Army's *Standards of Medical Fitness*?<sup>3</sup> If the answer is yes, appropriate steps to return the Soldier to duty, either in the same or a new military occupational specialty should be pursued. If the answer is no, the Soldier and the WTU triad must then consider, "Within the next 6 months, will the Soldier's condition and function improve sufficiently to meet retention standards in accordance with the Army's *Standards of Medical Fitness*,<sup>3</sup> or will he be a candidate to either continue on active duty or continue on active reserve?" If further treatment and rehabilitation will definitely or potentially return the Soldier to a condition that meets medical retention standards, further rehabilitation in the WTU is warranted. If further rehabilitation or treatment will not bring the Soldier to a condition that meets retention standards, or bring the Soldier to a level of function that will permit continuation on active duty, then preparation for entry into the physical disability evaluation system is warranted, and continued rehabilitation and treatment in the WTU is indicated only in extraordinary circumstances.<sup>4</sup> Examples of extraordinary circumstances include:

- A significant injury that warrants longer rehabilitation effort (indicated by the receipt of Traumatic Servicemembers' Group Life Insurance\* or entry into the Army Wounded Warrior Program)
- A significant illness that medical staff determines has a good prognosis for full recovery and return to duty. In this case, the WT's activities should be directed towards return to duty skills and activities, with vocational activity in an appropriate unit.

To facilitate assistance with possible transition to life as a Veteran, WTs referred to the Medical Evaluation Board should attend the Transition Assistance Program (TAP) or Disabled TAP, while WTs referred to the Physical Evaluation Board will meet with a Veterans benefits counselor onsite or at the installation's Benefits Delivery at Discharge office.

Upon referral of the WT to the Medical Evaluation Board, attention must be paid to transition services the Family members may need, in addition to those required by the WT. For example, if the WT has a

Family member with significant health concerns or exceptional needs, consideration must be given to how those needs will be met if the Soldier is separated from the Army. Coordination for appropriate care and services after the Soldier's separation must be initiated when the Soldier is referred to the Medical Evaluation Board. Such coordination will significantly reduce the Soldier and Family stress related to either the medical or Physical Evaluation Board process.

### PROFILES

To alleviate confusion upon assignment or attachment to the WTU, the primary case manager evaluates the WT's profile and determines if it adequately addresses all limiting conditions. The primary case manager may choose to write a new temporary profile. Physicians write profiles for 2 reasons:

1. To prevent the Soldier from causing an injury to himself or others. The Soldier may be motivated, but the risk of injury is too high or the consequences too severe to not write the profile. An example might be a helicopter pilot with a current seizure disorder. No matter how motivated that Soldier may be, the consequences would be too severe and a no-flying duty profile would be required. Another example is a Soldier that has mobility limitations that would prevent him from evacuating a burning vehicle or taking cover in the event of an attack. Another example is the Soldier with post-concussive syndrome (often called mild traumatic brain injury). To protect the brain while it is healing, the physician may opt to write a no-alcohol profile. No-alcohol profiles may also be considered when a Soldier has other diagnoses or is taking certain medications.

2. To protect the Soldier from undo pain and suffering. Only the Soldier can determine what is unreasonable for him or her with respect to pain. Not all Soldiers with knee pain need a profile that necessitates a Medical Evaluation Board and separation from the Service. The Soldier must understand that they are the best judges of what they are capable of. To facilitate retention, the Soldier should strive to meet the following minimum standards<sup>5</sup>:

- Be able to take an aerobic fitness event (run, walk, bike, or swim).

\*Traumatic Servicemembers' Group Life Insurance is a traumatic injury protection rider under SGLI that provides for payment to any member of the uniformed services covered by SGLI who sustains a traumatic injury that results in certain severe losses. Source: VA website, available at <http://www.insurance.va.gov/sgli/tsgli/tsglifaq.htm>.

## The Comprehensive Care Plan: Building the Strength to Do Well Tomorrow

Table 2. Monthly workload for the Warrior Transition Unit primary care manager in a 216 member unit accessing 36 new arrivals each month.

36 new intakes 1 hour each	36 hours
36 WTU triad goal-setting meetings 1 hour each	36 hours
36 decision point meetings 0.5 hours each	18 hours
4 WTU triad synchronization meetings 2 hours each	8 hours
<b>Total hours required for new arrivals and standing meetings</b>	<b>98 hours</b>
Available hours: 21 duty days @ 8 hours	168 hours
<b>Remaining total hours for all other appointments throughout the month</b>	<b>70 hours</b>

The primary care manager will therefore have 3.3 hours each day during the month for all other appointments, including sick call (acute care), medication reconciliation, profile evaluation, routine appointments, and meetings with other healthcare providers.

- Be able to fire a personal weapon, either shoulder-fired or handheld.
- Be able to wear the personal protective equipment (chemical protective gear, helmet, individual body armor vest).

### PLANNING FACTORS

A WTU in a steady state—the standard number of 216 Warriors in Transition who stay an average of 180 days—will gain an average of 36 new Soldiers every month. The primary care manager and one of the nurse case managers will perform the intake processing for these 36 Soldiers (36 hours a month), attend 36 goal-setting WTU triad meetings per month (36 hours a month), and attend 36 decision point meetings (18 hours a month). The steady state workload for the primary care manager is summarized in Table 2. The occupational therapist and social worker will also need to perform new intakes for these 36 Soldiers and may be requested to attend goal-setting and decision point meetings for certain Soldiers. The military treatment facility should consider the workload requirements when providing their clinical staff with adjunctive

personnel and support staff. WTUs that have attained a steady state can calculate their requirements by reviewing the number of new WTs received each month.

### SUMMARY

The Warrior Transition Units provide Soldiers an opportunity to focus fully on healing, with the goal of returning to duty or returning to civilian life as a successful Veteran, with success defined as employable (or a life-care plan established), capable of maintaining relationships, and proud of their service to the nation. The success of the individual Warrior Transition Unit will be determined by how well they assist their Warriors in Transition. The Warrior Transition Unit cadre must ask:

Is our WTU doing everything it can to build-up our Warriors?

Are we providing them with the tools to develop their Strength to Do Well Tomorrow?

### REFERENCES

1. *Public Law 104-191 Health Insurance Portability And Accountability Act Of 1996*. August 21, 1996: Available at: <http://aspe.hhs.gov/admsimp/pl104191.htm>.
2. *Army Pamphlet 640-1: Officer's Guide to the Officer Record Brief*. Washington, DC: US Dept of the Army; April 1, 1987.
3. *Army Regulation 40-501: Standards of Medical Fitness*. Washington, DC: US Dept of the Army; December 14, 2007.
4. *Department of Defense Instruction 1332.38: Physical Disability Evaluation*. Washington, DC: US Dept of Defense; November 14, 1996.
5. *Army Regulation 600-60: Physical Performance Evaluation System*. Washington, DC: US Dept of the Army; June 25, 2002.

### AUTHOR

LTC(P) Dominguez is the Executive Officer to the Assistant Surgeon General for Warrior Care and Transition, Office of The Surgeon General, Alexandria, Virginia.

# Ensuring Excellence: The Warrior Transition Unit Staff Training Program

Sherri A. Emerich, MA

## BACKGROUND

The Army Medical Action Plan established the development and delivery of standardized training for the staff of the Warrior Transition Units (WTU), with special focus on the "WTU Triad." The triad consists of the squad leader, the nurse case manager, and the primary care manager. Every Warrior in Transition (WT) is assigned to a triad upon joining the WTU. While training is not the entire solution to progress and improvement, it is a key component in the change process. Indeed, standardized training for WTU staff was one of the 10 "quick wins" established by the Army Assistant Surgeon General for Warrior Care and Transition when the Army Medical Action Plan was unveiled in June 2007.

In August 2007, the Academy of Health Sciences (AHS) at the Army Medical Department (AMEDD) Center and School was tasked to accomplish the new training requirement. Very quickly, great things began to happen. When an Army need for training is combined with overwhelming support and subject matter expertise, the result is exceptional quality training.

## DISTRIBUTED LEARNING

The training mission was initiated with a request for the development and delivery of distributed learning on a variety of subjects. The first suspense was short. The team included subject matter experts, distributed learning developers and deliverers, instructional systems specialists, AHS quality assurance personnel, and training systems specialists. The initial training product was the short-term, short-suspense solution. This product has since been improved. The AHS is currently working on the third revision. Future phases of improvement include producing a Sharable Content Object Reference Model\* compliant product which will improve sequencing and standardization.

Two distributed learning training courses were developed to provide an overview of the WTU and all its services and functions. Recently it was determined that all staff members of a WTU would benefit from the information and training provided by both courses. Therefore, these courses were combined into a single course, the Warrior Transition Unit Cadre Orientation course.<sup>†</sup> It is located on the Army Learning Management System. Soldiers can enroll in this course via the Army Training Requirements and Resources System as a self-development course.

The WTU Cadre Orientation course encompasses 28 lessons as shown in Table 1. Additional lesson topics have been identified for consideration and development.

In addition to the overview course, nurse case managers are also required to take the Warrior Transition Unit Nurse Case Management course.<sup>‡</sup> This course covers nurse case management roles and responsibilities with special attention to the WTU patient population. Distributed learning modules on case management, ambulatory care guidelines, utilization management, post-traumatic stress disorder, and traumatic brain injury are integrated.

## BRIDGING THE GAP

Further into the Army Medical Action Plan, it was determined that the WTU triad and platoon sergeants should attend resident training in addition to the distributed learning. The resident course will be launched in October 2008. However, to provide resident-type training as soon as possible, interim types of training were established to bridge the gap between distributed learning and the resident course.

## LOCALLY CONDUCTED TRAINING

At a January 2008 conference in San Antonio, 7 lessons were delivered to designated trainers or

\*A Dept of Defense set of standards and specifications for development and delivery of electronic learning.

<sup>†</sup>Army Training Course 6I-F8/300-F36

<sup>‡</sup>Army Training Course 6E-F2

## Ensuring Excellence: The Warrior Transition Unit Staff Training Program

training coordinators from each WTU. The designated trainers will either deliver the training or coordinate the training employing local subject matter experts. The training must be provided to the WTU staff by the end of September 2008. Documentation is completed in the Digital Training Management System (DTMS). The 7 lessons are designed to engage the staff through discussions, videos, practical exercises, and scenario-based training. The training topics include:

- Post traumatic stress disorder and traumatic brain injury
- Pain management
- Drug and alcohol awareness
- Suicide prevention
- Army physical disability evaluation system
- Personal goal setting
- Basic medical terminology
- Command and control/personal accountability

The medical terminology training is intended for nonmedical staff. Many of the squad leaders and platoon sergeants in the WTUs and community based healthcare organizations (CBHCOs) are not medical professionals. While the lesson on command and control is beneficial to all, its focal point is the squad leader and platoon sergeant.

### ARMY CENTER FOR ENHANCED PERFORMANCE TRAINING MODULES

The Army Center for Enhanced Performance\* (ACEP) will send training teams to each of the WTUs and CBHCOs between February and September 2008. Training from the ACEP teams takes a more holistic approach to training, using advanced performance psychology and academic strategies to enhance personal and professional performance and strength. Training is provided at the mental and emotional level of human performance. Physical, technical, and tactical training are already done well by the Army. The training modules embrace the following:

\*The Army Center for Enhanced Performance is a department of the US Military Academy Preparatory School, West Point, New York. Information is available at: [http://www.usma.edu/USMAPS/pages/academics/cep\\_home.htm](http://www.usma.edu/USMAPS/pages/academics/cep_home.htm).

Table 1. The current composition of the Warrior Transition Unit Cadre Orientation Course.\*

1	Orientation
2	WTU Integrated Management Team
3	Service Support
4	WT Integration and Disposition
5	Army Wounded Warrior Program
6	Compassionate Leader
7	Cadre (staff) Resiliency
8	Army Career and Alumni Program
9	Soldier Financial Readiness Visibility System
10	Physical Profiles
11	Community Based Healthcare Organization
12	Assisting Veterans with Traumatic Brain Injury
13	Seamless Transition
14	Transition Assistance Advisors
15	Veterans Administration
16	Veterans Benefits Administration Compensation and Pension Services
17	Vocational Rehabilitation and Employment
18	Women Veterans Program
19	Combat-related Injury Rehabilitation Pay
20	Computer-Electronic Accommodations Program
21	Mobilization Process
22	Tricare <sup>†</sup> Overview
23	Traumatic Servicemembers' Group Life Insurance
24	Medical Evaluation Boards
25	Physical Disability Evaluation System
26	Human Resources Command
27	Ombudsman
28	Suicide Awareness

\*Army Training Course 61F8-300-F36

†TRICARE is the DoD health care program for members of the uniformed services, their families, and their survivors. Information available at <http://www.tricare.mil>.

- Life coaching awareness and providing strength to others
- Psychology of injury and healing
- Mental skills foundations to better use the mind to enhance performance

- Confidence building
- Goal setting
- Integrating imagery
- Attention control and active listening
- Energy management
- Team building

### **SENSITIVITY TRAINING**

Sensitivity training will be delivered via unit ministry teams. They will emphasize the provision of compassionate and sensitive care in support of the WTUs and their Families. Squad leaders and platoon sergeants find themselves in an atypical leadership role in a WTU. Firm, yet compassionate leadership is required.

### **RISK COMMUNICATION TRAINING**

Professional Risk Communication training will be delivered to the WTUs by the Army Center for Health Promotion and Preventive Medicine (CHPPM). This training uses education and scenarios to help the staff to better plan and execute communications in high risk/low trust environments. Learning to apply the principles of risk communication is a fundamental imperative for the triad. A single bad communicator, albeit someone with really good intentions, can affect the healing process. The training is excellent and is highly recommended for anyone, especially those whose job entails complex interactions and communication in a trusting environment.

### **RESIDENT COURSE**

The first resident course will be presented in October 2008. Two weeks are blocked for this course, although the program of instruction is not final. All members of the WTU triad and all platoon sergeants will attend. The ACEP team is responsible for the first week of the course which will be devoted to coaching, mentoring, and education. The training is a more thorough version of the current interim training package. The ACEP team at Fort Sam Houston is presently developing curriculum specifically for this course.

The second week will include a 6-hour, comprehensive lesson in Risk Communication. The course will also include sensitivity training and an overview of the

DTMS. The lessons previously delivered by WTU designated trainers will be provided by the subject matter experts that designed and developed the lessons. Professional videos have been scripted and are under production for training in both suicide prevention and suicide intervention. The AHS Soldier and Family Support Branch, AMEDD television production specialists, and CHPPM are collaborating on this project. The last part of the course will involve breakout groups similar to technical track training. Squad leaders and platoon sergeants, along with nurse case managers and primary care managers, will receive role-specific training. The AMEDD Noncommissioned Officers Academy will play a vital role in squad leader and platoon sergeant training.

### **TRAINING SUMMARY**

The current training requirements for WTU staff are shown in Table 2. It should be noted that after September 30, 2008, there is no longer any mandatory requirement for the local classroom training shown in Table 2, as the learning objectives covered in that training are included in the resident course described above. However, this does not preclude local commands from presenting such related training as they deem necessary.

### **THE ROAD AHEAD**

The WTU Triad Training Program is evolving. Recently, as directed by the Army Training and Doctrine Command, a WTU overview training support package was developed for implementation into Army leadership courses. A WTU breakout session was just established for the AMEDD Pre-Command Course. The WTU Triad Training Program website was established. The mission is expanding. Additional distributed learning content is under development for the orientation course which will cover Family Readiness Support Assistants. Lessons in Personnel (S1) and Comprehensive Care Planning are in the analysis phase. Professional expertise and suggestions are common resources during this planning and development evolution.

Although there is a vast amount of expertise within the schoolhouse, involvement extends above and beyond the AHS. Professional expertise is not limited to schoolhouse resources. Knowledgeable and practiced professionals outside of the AHS, such as ACEP and

## Ensuring Excellence: The Warrior Transition Unit Staff Training Program

CHPPM, are integral contributors to this program. We will continue with interviews of WTU staff and commanders to sustain a program of instruction that is current and relevant. As the program progresses, we will use survey tools, observations, interviews, and other forms of evaluation and analysis to preserve a quality training program.

As the population of experienced WTU staff members grows, we must capture their tacit and explicit knowledge and find a way to proliferate it, creating an educational circle among the incoming and outgoing members of the WTU triad. The power of knowledge can only achieve its full potential if we share it with as many people as possible. Imagine 100 people in a

room with probes and wires interconnecting their brains. Then, with the flip of a switch, all of the information and knowledge in each brain is shared with the others. While our program includes no probes or wires, we do want our training program to share knowledge in an interactive and engaging manner. We want to do more than train; we want to improve human performance.

### AUTHOR

Ms Emerich is the Program Director of the Warrior Transition Unit Training Program, Academy of Health Sciences, AMEDD Center and School, Fort Sam Houston, Texas.

Table 2. Current mandatory training requirements for staff personnel assigned to all US Army Warrior Training Units.

	Distributed Learning Courses		Classroom Training at Local Installation			
	Warrior Transition Unit Orientation*	Nurse Case Management <sup>†</sup>	ACEP Mobile Training <sup>‡</sup>	Unit Ministry Team Sensitivity Training <sup>‡</sup>	Locally Conducted Training <sup>‡</sup>	Risk Communication Mobile Training <sup>‡</sup>
Squad leader	✓		✓	✓	✓	✓
Primary care manager	✓		✓	✓	✓	✓
Nurse case manager	✓	✓	✓	✓	✓	✓
Platoon sergeant	✓		✓	✓	✓	✓
All other WTU staff	✓		✓ <sup>§</sup>	✓ <sup>§</sup>	✓ <sup>§</sup>	✓ <sup>§</sup>

\*Either the Warrior Transition Unit Cadre Support course (Army Training Course 6I-F6/300-F34) and the Warrior Transition Unit Support Orientation course (6I-F7/300-F35), or the Warrior Transition Unit Cadre Orientation course (6I-F8/300-F36)

<sup>†</sup>Army Training Course 6E-F2(P)

<sup>‡</sup>Course mandatory until September 30, 2008. After that date, personnel assigned as squad leaders, primary care managers, nurse case managers, and platoon sergeants must attend the resident WTU training course presented at the AMEDD Center and School, Fort Sam Houston, Texas.

<sup>§</sup> Not required after September 30, 2008

# ***The Role of Occupational Therapy in Warrior Transition Units***

COL Mary W. Erickson, SP, USA

The primary mission of a Soldier assigned to a Warrior Transition Unit (WTU) is to heal. The combination of a familiar military living environment, medical and rehabilitation services, and set daily routines with individualized goals help Warriors in transition focus on activities that promote healing in the physical, mental, social, and spiritual domains of life.

The role of occupational therapy (OT) within a WTU is to help Soldiers attain optimal occupational performance and gain a sense of mastery as they transition back to independent, productive living. The WTU OT promotes the Soldier's return to the role of worker, whether military or civilian. Occupational therapy practitioners promote, improve, conserve, and restore the skills, abilities, and aptitudes of the Warrior in Transition. They help guide Soldiers toward reasonable short and long-term goals that reflect the Soldier's avocational (nonpaid or volunteer) and vocational interests. A supportive military environment combines with engagement in purposeful work activities that match the Soldier's interests and skills to help them overcome physical, mental, or emotional barriers and view themselves as competent workers. This perspective is absolutely essential for them to gain control over their daily lives and take personal responsibility for their future.

Occupational therapy is designed to achieve functional outcomes through a focus on the therapeutic use of occupation—tasks and activities within one's daily life which provide meaning and purpose. Occupational performance may be related to areas of work, play, education, leisure, self-care, or social participation. Engaging the Soldier in therapeutic occupations that are based on his/her current functional ability helps build a sense of competence and self-confidence. "Engagement in occupation includes both the subjective (emotional or psychological) aspects of performance and the objective (physically observable) aspects of performance."<sup>1</sup> Occupational therapy practitioners consider the interplay between the environment, the person, and occupational

performance in matching interests, skills, and abilities with intervention options. Occupational therapy practitioners address occupational patterns such as roles, routines, and habits within a broad context: cultural, physical, social, temporal, spiritual, and virtual. Engagement in Soldier tasks and duty responsibilities as early as possible helps the Warrior in Transition maintain the ingrained habits that support the role of being a Soldier.

Occupational therapy practitioners incorporate therapeutic use of self, consultation, and educational approaches to help meet the needs of Warriors in Transition. The WTU OT staff includes a licensed, registered occupational therapist—who holds a bachelor's or master's degree—and certified occupational therapy assistants who hold associate degrees. Occupational therapy practitioners must complete supervised clinical internships in a variety of health care settings, pass a national certification examination, and complete licensure requirements in most states. They are trained in human growth and development with specific emphasis on the social, emotional, and physiological implications of illness and injury. Occupational therapy practitioners facilitate increased Soldier involvement in productive activity while addressing safety, physical tolerance, and functional abilities. They are able to develop and guide job-specific programs of graded activity, job task analysis, job station modifications, and can identify and address work behaviors.<sup>2</sup>

Occupational therapy practitioners provide consultation and collaboration support in many areas. They partner with the Computer/Electronics Accommodations Program to provide assistive technology assessments for Soldiers demonstrating functional deficits. Occupational therapy practitioners provide consultation support to help the WTU address ergonomic issues, meet Americans with Disabilities Act<sup>3</sup> requirements, and create safe barrier-free environments. They help identify the need for specific life skills training/classes and interface with the

## The Role of Occupational Therapy in Warrior Transition Units

Army's Center for Enhanced Performance,\* incorporating a peak performance model to build Warrior performance skills. In addition, OT practitioners may provide cognitive and behavioral health assessment and intervention strategies; ensure that an interface with the Department of Defense, the Department of Veterans Affairs (VA), and civilian providers exists; connect with VA vocational assessment resources, work adjustment, and work transition resources; and work closely with Family and community resources.

The interactive nature of occupational therapy requires a close working relationship with the Soldier and the "WTU triad" (primary care manager, nurse case manager, and squad leader). Regular contact with the social worker, chaplain, and the WTU command team, as well as the military treatment facility (MTF) staff assures continuity of care. A close working relationship is maintained with the VA Vocational Readiness and Employment branch that addresses return to work. An early interface with vocational rehabilitation counselors for those who will be entering the VA system assures a smoother transition.

Occupational therapy practitioners work closely with the WTU triad to incorporate specific therapeutic activities into the Soldier's training calendar as part of his or her duty day. Such activities may include requirements of daily living (maintaining a military appearance), educational activities (selected life skills training or Soldier task training), work/productive activities (duty assignments that match individual interests, skills, and abilities), leisure/recreational activities (participation in enjoyable, relaxing activities, games, and sports), and social participatory activities (cooperative/competitive sports, games, ceremonies, or celebrations).<sup>4</sup>

Life skills training and education help prepare Soldiers for successful reintegration into military duty, or for return to their home and community living. A team approach is used to identify and meet the needs of Warriors in Transition. The OT staff collaborates with the WTU operations staff, the MTF, and garrison resources to implement basic and advanced training to

meet the Soldier's basic skills needs in the following areas:

- Goal planning
- Managing stress and energy
- Communication skills
- Managing a healthy weight and nutrition status while recovering from injury or illness
- Managing/reestablishing cardiovascular fitness
- Conflict resolution
- Managing healthy relationships
- Financial management skills
- Basic relaxation techniques and sleep hygiene
- Maintaining balance/time management
- Basic introduction to illness and injury including avoidance of addictions and medication management

Advanced life skills training is provided according to the Soldier's needs, including:

- anger management, assertiveness and communication skills,
- concentration skills,
- Warrior basic skill training and return-to-duty skills,
- specific problem solving, and
- goal setting.

Specific skills training in the area of work readiness includes:

- work habits,
- values,
- interests,
- work skills, and
- vocational exploration.

### THE VALUE OF WORK

*Duty* is a Soldier's work. It is expected of all Soldiers. To a Warrior in Transition, work or duty assignments are viewed as therapeutic and are designed to improve health. The concept of work as a therapeutic medium has been a core concept since the inception of occupational therapy. Work programs for individuals with mental illness began during the "Moral Treatment" movement of the late 18th and early 19th centuries. George Barton, one of the founders of

\*The Center for Enhanced Performance is a department of the US Military Academy Preparatory School, West Point, New York. Information is available at [http://www.usma.edu/USMAPS/pages/academics/cep\\_home.htm](http://www.usma.edu/USMAPS/pages/academics/cep_home.htm).

occupational therapy, established a program in New York in the early 19th century that incorporated the use of occupations to return individuals recuperating from illness or injury to productive living. He stated, "The purpose of work was to divert the mind, exercise the body, and relieve the monotony and boredom of illness."<sup>5</sup> In 1918, the Army's Division of Orthopedic Surgery organized a reconstruction program for disabled soldiers and trained reconstruction aides to use "work activities to return the injured soldiers to military duty or civilian life to the highest degree possible."<sup>4</sup> Reconstruction aides were the precursors of today's occupational therapists.

Work often provides a sense of security, belonging, and self-esteem; it is a role with which all Soldiers can identify. The process of returning to work begins as soon as the Soldier enters the medical system. It requires a collaborative team approach as Soldiers transition between acute rehabilitation and work rehabilitation. When the Soldier enters the WTU, the OT practitioner performs an initial screening to address life skills, occupational performance, and potential for work placement. During intake, a collaborative assessment addresses the Soldier's occupational history (both military and civilian), training and education, functional abilities and deficits, and future plans and goals. This assessment helps the Soldier identify occupational goals, identify avenues to reach those goals, and instill the mindset to achieve the stated goals. Occupational therapy assessments may include, but are not limited to

- life skills assessments,
- cognitive assessments,
- vocational interest surveys,
- vocational aptitude and career assessments,
- occupational performance assessments,
- Warrior functional capacity evaluations, and
- use of driving or firearm training simulators.

Occupational therapy practitioners assess limitations that prevent or delay the return to the worker role and provide recommendations for modifications and/or equipment needs.

Following the initial intake, eligible Soldiers are assigned to a meaningful job that is within the limits of their physical profile and commensurate with their

grade. The Soldiers are placed in duty assignments that incorporate military occupational specialty related tasks, training, and/or education toward an occupational goal. Occupational therapy practitioners work closely with the WTU triad to coordinate vocational training, job skills training, and work placement for Soldiers, with consideration given to the skills and interests of the Soldier. The WTU will maintain a file on each work reintegration site which includes, but is not limited to the job description (duty/work hours, dress code, and point of contact), a memorandum of agreement, and the physical, cognitive, and psycho-social job requirements. The squad leader, in consultation with OT, will maintain regular contact with the work site and will record/report the Soldier's work performance and satisfaction.

Community reintegration activities help prepare the Soldier for successful daily life as an active participant within the community. Duty assignments that involve the VA work programs and/or other vocational or work programs may help the Soldier identify and access resources within the community. Addressing community mobility, including public transportation or driving skills, and practicing enrollment in educational activities while still in the WTU help to ease the Soldier's transition back to community living. Participation in recreational or sports activities and community outings also helps maintain a link to the community while preparing the Soldier to pursue independent leisure activities. The Soldier's Family or care provider may be engaged in the development of a transitional care plan and or life care plan when additional or ongoing services are required. The OT practitioner develops collaborations within the community to determine resources and to prevent duplication of services.

In summary, occupational therapy's role in the WTU applies a functional approach to healing through doing, by matching the individual's interests, skills, and abilities with activities that have meaning and purpose, along with the "just right" challenge. A focus on occupational performance helps restore confidence and competence. Life skills components promote functional independence that will enhance future quality of life, while preparing the Soldier for a lifetime of productive living. Participation in work

## The Role of Occupational Therapy in Warrior Transition Units

reintegration promotes a sense of mastery, a positive self-identity, and the acceptance of personal responsibility and control over one's own future.

### REFERENCES

1. American Occupational Therapy Association. Occupational therapy practice framework: domain and process. *Am J Occup Ther*. 2002;56:609-639.
2. American Occupational Therapy Association. OT Services in Work Rehabilitation. Available at: <http://www.aota.org/practitioners/resources/docs/factsheets/conditions/39826.aspx>. Accessed 23 February, 2008.
3. Americans with Disabilities Act, 42 USC §§ 12101-12213 (1990).
4. FM 4-02.51. *Combat and Operational Stress Control*. Washington, DC: US Dept of the Army; July 2006: chap 12, sec 12-6.
5. Pendleton HM, Schultz-Krohn W, eds. *Pedretti's Occupational Therapy: Practice Skills for Physical Dysfunction*. 6th ed. Burlington, Massachusetts; Elsevier: 2007:265-266.

### AUTHOR

#### COL DEBBOUN IS THE NEW CHAIRMAN, *AMEDD JOURNAL* EDITORIAL REVIEW BOARD

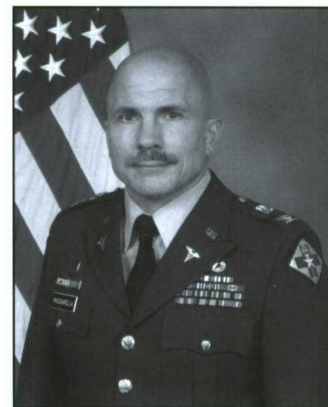
#### COL PASQUARELLA JOINS THE BOARD

After seven years, COL James M. Lamiell, MC, USA, is leaving his position as Chairman of the *AMEDD Journal* Editorial Review Board. COL Lamiell is an original member of the Board, joining as Chairman in November, 1999. Throughout his tenure, COL Lamiell has been a steadfast advocate for the *Journal*, and we thank him for his dedication to the high standards and professional quality of this publication, and his years of leadership and support to our mission.



The new Chairman of the Editorial Review Board is COL Mustapha Debboun, MS, USA. COL Debboun is Chief, Medical Zoology Branch, Academy of Health Sciences, AMEDD Center & School, Fort Sam Houston, Texas, and a current member of the Board.

The *AMEDD Journal* also welcomes COL Michael A. Pasquarella, MC, USA as a new member of the Editorial Review Board. COL Pasquarella is Chief, Department of Medical Science, Academy of Health Sciences, AMEDD Center & School, Fort Sam Houston, Texas.



*The Editors*

# What Can Social Workers Do for Warriors in Transition?

René J. Robichaux, PhD, LCSW  
COL Nicole M. Keesee, MS, USA

The Warrior Transition Units (WTU) are providing an alternative to the traditional disease model which suggests that individuals who are wounded, ill, or injured can only achieve recovery and optimal health by addressing the physical consequences of their illness or injury. In the disease model, those Soldiers whose physical conditions lead to a disability are often treated as people who are incapable of becoming healthy. The alternative social model describes disability as a form of socially imposed restrictions and barriers that can be removed to return the person with disability to good health. The outcome of combining the best aspects of both models results in a holistic approach to caring for people. A holistic model of recovery and rehabilitation focuses on the social context of wounded, ill, and injured Soldiers (Warriors in Transition) in addition to addressing their medical needs. It is the responsibility of the multidisciplinary treatment team, including the social worker and "WTU triad" (primary care manager, nurse case manager, and squad leader), to ensure the delivery of optimal health care and also to collectively eliminate barriers, restrictions, and the stigma associated with injury, illness, and disability. By adhering to these two responsibilities, Soldiers are able to focus on both physical and psychological healing and a return to good health.

Social workers are trained to view an individual as a person-in-environment. In regards to the *person*, social workers lead the way in assessing and addressing the spiritual, intellectual, emotional, physical, and social aspects which comprise the "whole" person. As for *environment*, social workers are concerned about living conditions impacting healing and recovery. In short, social workers have 2 clients when working with an individual—the person and their community. By addressing both the person and their social community, social workers are in a stronger position to help Warriors in Transition and their families by shaping

their environment in order for them to achieve a full recovery.

The holistic approach to healing and recovery is based on the recognition that Warriors in Transition are whole persons with complex psychosocial needs and should not be defined solely by their medical condition. Not all Warriors in Transition will require social work services, but all will require a social work assessment. This assessment helps the treatment team, WTU triad, and Soldier identify and capitalize on the Soldier's strengths throughout the recovery and healing process. Not only is the Soldier capable of returning to good health, but he learns to gain more control over his life, maintain a positive self image and identity, improve and strengthen primary relationships, develop self-care skills, and overcome social and cultural obstacles.

Social workers take into account the diversity of the population they serve, including service orientation, rank, occupational specialty, age, race, ethnicity, family structure, gender, religion, and sex. Mackelprang and Salsgiver<sup>1</sup> present 6 guiding social work principles associated with disability which I have adapted to the Warrior in Transition population for the purpose of this article:

1. Warriors in Transition are capable and have potential.
2. Devaluation and the lack of resources are primary obstacles facing Warriors in Transition.
3. Social and political interventions must be emphasized with Warriors in Transition.
4. There exists a negative attitude about injury and illness within the military culture which professionals should be aware of in order to facilitate the empowerment of Warriors in Transition.

## What Can Social Workers Do for Warriors in Transition?

5. There is joy and vitality to be found in being a Warrior in Transition.
6. Warriors in Transition have the right to self-determination and the right to guide professionals' involvement in their lives.

For more information about the medical, social, and holistic approach to people with disability, I recommend the article by Kim and Canda.<sup>2</sup>

The behavioral health social worker assigned to the WTU provides a comprehensive behavioral health and psychosocial assessment for all Warriors in Transition, manages risks identified during the interview/assessment, and documents into AHLTA\* the actions taken, ensures Soldier and/or Family member counseling/treatment using the appropriate modality (if indicated), collaborates with the WTU triad and other members of the multidisciplinary treatment team, and provides a variety of social work services as indicated.

The primary responsibility of the behavioral health social worker is to provide the Soldier and the health care team with a comprehensive psychosocial assessment of the Soldier's behavioral health needs at the time of their attachment or assignment to the WTU. Through self-assessment questions and structured interviews, the behavioral health social worker will be able to identify Soldiers who are experiencing psychological distress such as depression, anxiety, and post-traumatic stress disorder, who may be struggling with alcohol abuse, sleep disturbance, mood problems, excessive anger, relationship problems, and feelings of hopelessness. In addition, the assessment will help identify those Soldiers in need of a more in-depth evaluation and/or identify Soldiers who might not have been previously diagnosed with mild traumatic brain injury. Once the assessment is completed, the role of the social worker is to manage the identified risks (problems) and ensure that further specialty evaluations are initiated. The social worker will work closely with the WTU nurse case manager to ensure that a comprehensive behavioral health treatment plan is developed and initiated. While Warriors in Transition may see other members of the behavioral health treatment team, such

as a psychiatrist for medication, and a psychologist for cognitive behavioral therapy, the social worker can help the Warrior in Transition with relationship problems that have been created by or exacerbated by their injuries. In order to best help the Warriors in Transition, the social worker may need to involve their spouses, family members, and/or significant others in their treatment. There may also be times when the social worker will need to intervene with other systems on the Soldier's behalf, to ensure the Warrior in Transition receives the best care possible. To maximize the effectiveness of the social worker in providing comprehensive behavioral health services, it is imperative for the WTU triad and multidisciplinary team to refer the Soldier and/or Family members and encourage full participation with the social work assessment and follow-on services.

In summary, good health is often defined as the absence of disease, injury, or impairment. The holistic approach to treatment allows health care professionals to view Warriors in Transition as capable of returning to duty. Social workers are trained to excel in 4 areas: advocacy, resourcing, networking, and the provision of services. A social work presence within the WTU is essential to the promotion of Soldier health and well being.

---

### REFERENCES

1. Mackelprang R, Salsgiver R. *Disability: A Diversity Model Approach in Human Service Practice*. Pacific Grove, CA: Brooks/Cole Publishing Company; 1999.
2. Kim KM, Canda ER. Toward a holistic view of health and health promotion in social work with people with disabilities. *J Soc Work Disabil Rehabil*. 2006;(2):49-67.

---

### AUTHORS

Dr Robichaux is Social Work Programs Manager, Behavioral Health Division, US Army Medical Command, Fort Sam Houston, Texas.

COL Keesee is Coordinator, Continuum of Care and Transition Services, Warrior Transition Office, Warrior Care and Transition Directorate, Office of The Surgeon General, Falls Church, Virginia.

---

\*The US military electronic medical record

# Facilities Maintenance: Uncovering the “Black Hole”

MAJ Ricky Smith, USAR

## YOUR DREAM JOB TURNS INTO YOUR WORST NIGHTMARE

You have just landed that coveted commander or deputy commander position and you are riding high. You have great plans for the world of healthcare and are planning how you will improve the care your MTF provides its patients, when your world is turned upside down by a major facility catastrophe. It doesn't have to be a front page article in a nationally read newspaper. It could be a failing mark on a Joint Commission\* survey or other inspection. It could be an equipment malfunction that prevents you from providing a key service or, worse, results in injury or death to a patient or staff member. Imagine the following scenarios:

**Scenario #1:** Your facility is undergoing an inspection. As the investigation group enters your older facility it seems to be well maintained. No one in the facility manager's office seems nervous. Everyone seems professional and at ease. The inspection team asks the facility manager to present specific facilities metrics which he seems to know off the top of his head, but readily pulls them from his computer. The inspection team walks around and finds a facility that is well-maintained. The team leaves with the impression that the facility manager knows his job and the facility is well maintained.

**Scenario #2:** Your facility is undergoing an inspection. As the investigation group enters your older facility, the facility manager seems evasive and on edge. When an investigator requests to see numerous metrics, the facility manager states he will need to call his “computer guy.” The computer guy comes in and is still not able to produce the metrics, but does produce a list of reasons why they did not have the data and tells the group who was to blame for the system not working correctly. The facility manager tells the group the problem could be resolved within one week, but a

review of the records indicates very little data had been entered for at least 7 years. The inspection team walks around and finds a facility that is poorly maintained. The team leaves with the impression that the facility manager does not know his job and the facility is poorly maintained.

Those are actual scenarios from Army Medical Command (MEDCOM) inspections of MEDCOM facilities. Obviously you want to be involved in scenario #1, not scenario #2, but waiting until inspection day to find out what scenario you represent is probably not the wisest course of action. Most facility managers know their business and will keep the facility out of trouble, but how do you know you have facility manager #1 and not facility manager #2? You do not want to wait for a death or injury or for your MTF to be on the front of the local news, or until you are in the middle of an inspection to find out. You don't have to be an expert in facility maintenance yourself to get an indication of the quality of your maintenance program. This article will give you some tools to assess your program.

### FACILITY FACT:

**Facilities found in good condition always have good maintenance data.**

Here are a few of questions you may want to ask your facility manager when you first meet in his/her office:

What are our critical assets and how did you determine them?

**Answer:** Critical assets should be ranked based on risk which should be determined by the commander with recommendations from the staff. The deputy commanders should help identify which assets are defined as critical. The highest risk asset may be one that would cause loss of life or limb if it were to functionally fail. The next highest risk assets would be those that would prevent you from performing your mission if they were to functionally fail. Functional

\*Joint Commission on Accreditation of Healthcare Organizations, One Renaissance Blvd, Oakbrook Terrace, Illinois 60181.

## Facilities Maintenance: Uncovering the "Black Hole"

failure means the asset is not meeting the needs of the owner. An example of high risk may be a backup generator for life support or fire protection system, or a steam sterilizer required for surgical procedures. Most facility managers will tell you that they "contract that maintenance out." That does not let them off the hook. They are still responsible to know the status of the maintenance and reliability of all assets, especially critical assets.

What is the preventive maintenance compliance percentage of our critical assets?

**Answer:** The preventive maintenance program compliance (reported as a percentage of preventive maintenance completed on time) for critical assets should be reported monthly to the MTF commander. The MTF commander should always be informed when preventive maintenance compliance for critical assets is less than 100% using the 10% Rule. The risk may not be acceptable.

The 10% Rule of Preventive Maintenance simply states that a preventive maintenance action scheduled for an asset must be completed within 10% of the time frequency. An example: If a preventive maintenance procedure is to be performed every 30 days, it must be completed within 3 days of that frequency or it is out

of compliance. I recommend you apply this rule only to critical or high risk assets.

What metrics are you using to measure the effectiveness of our preventive maintenance program?

**Answer:** You are looking for metrics which show a trend over time and are compared to other metrics (Figure 1). This chart should be developed and reported monthly to the MTF commander. In addition, ensure your facility manager can show you 100% of maintenance labor is covered by service or work orders.

What percentage of the priority 1 service orders are not completed within 24 hours?

**Answer:** The US Army standard is that priority 1 service orders are all completed within 24 hours. I would require this metric to be trended and include all priority 1 service orders on all assets. Do not accept excuses.

### WORRISOME COMMENTS FROM A FACILITY MANAGER

"These reports cannot be developed with the software they are currently using." The current software the US Army provides for maintenance of facilities will provide these reports if the data is entered.

"The contract does not state that we must track these metrics." This may be correct. However, I would immediately direct my contracting officer to modify the contract and ensure the metrics are tracked and used to determine contractor bonuses.

"Sir/Ma'am, let *me* do my job. You worry about the medical stuff, I'll worry about the maintenance stuff." You do want to let them do their job, but if they are uncomfortable with your questions, how much more uncomfortable will they be when an inspector is asking the questions?

### MAINTENANCE FALLACIES YOU WILL HEAR

Maintenance fallacies can result in failure. Have you heard them in your organization? These

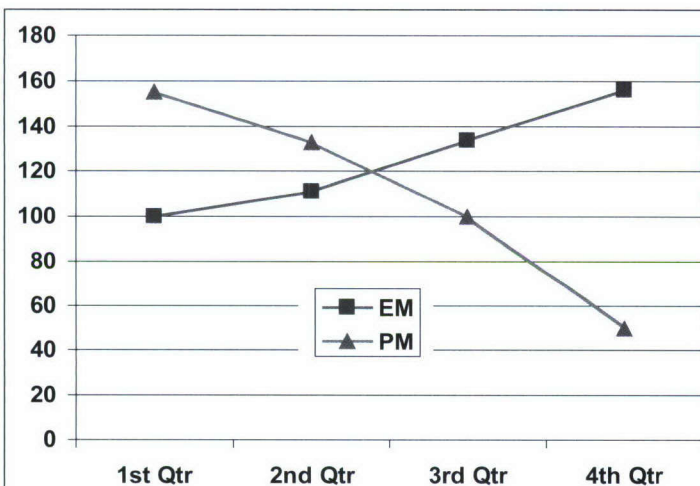


Figure 1. Chart illustrating the direct relationship between preventive maintenance (PM) labor hours and emergency maintenance (EM) labor hours. It is almost unavoidable that a decrease in preventive maintenance will result in an increase in emergency labor, with attendant disruptions in productivity and increased operating costs for the supported facility.

excuses are a joke among proactive maintenance organizations because they are not true.

### No time for preventive maintenance

High frequencies of emergency repair seem to take your available labor time away from preventive maintenance.

To get out of that spiral, you must first identify high priority assets, and restore them to a manageable maintenance routine.

Next, apply preventive maintenance procedures on a disciplined schedule. You will never overcome emergency maintenance burdens until you get preventive maintenance under control.

---

### Emergency repair frequencies keep going up for no known reason.

When you have so many problems you cannot deal with them, you must step back and develop a good plan to get them under control.

The first step is to track all failures by using a metric called mean time between failure (MTBF). This metric allows you to focus on the asset which is failing the most.

You derive the metric by dividing units of time by the number of emergency repair sequences occurring during that time. For example, performing 3 emergency repair sequences in 24 hours gives you a MTBF of eight.

---

### Not enough money to hire an expert

I once visited a facility where the roof had failed numerous times. Over the years during which the roof failed, the organization repeatedly repaired or replaced the ceiling, flooring, and walls. The maintenance manager explained that the roof was not repaired properly because the maintenance person was not formally trained in roofing but was the best on staff, and the manager could not afford to hire a roofing company. This statement seemed to ask more questions than it answered, since the cost of repeated roof repair and room damage must have far exceeded the cost of hiring a professional to repair it correctly in the first place.

### Not enough maintenance staff

You will never have enough maintenance staff if you do not reduce your emergency repair requirements for failing assets.

You also never will control the failures if you do not develop and manage a true preventive maintenance program focusing on critical assets first.

---

### Skimping on maintenance is acceptable because this building/equipment is scheduled for retirement.

Are the demands or expectations on a piece of equipment, or a facility, being reduced? If not, they must be maintained to full capability and functionality.

US Army Medical Command criteria for maintaining an asset is to follow reliability-centered maintenance methodology which states that an asset must meet the functional capability of the needs of the user. If the asset or facility does not meet user needs, it has failed functionally. Assets or facilities must be maintained to full functionality until they are permanently closed, retired, or deactivated.

### SEEING IS BELIEVING: USE THE EYE TEST TO CHECK YOUR FACILITIES

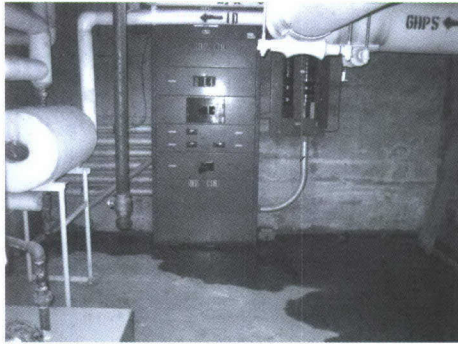
Start with you facility manager's office. Is it well maintained, clean, neat, and orderly? Can he or she readily provide the data you request?

Do an unannounced "walk-through" of your medical treatment facility and look for subtle hints of problems with your preventive maintenance program which could cause serious problems throughout your command. Ask for someone who knows their way around the facility (your facility manager will work) to give you a tour. Make sure you direct the tour and go where you want to go, to include any underground tunnels, mechanical rooms, storage areas, and other nonpublic areas. These rooms contain the air handlers that move the conditioned air into and out of the MTF. There may be pumping systems and pipes in those locations. Visit numerous mechanical rooms throughout the MTF and take notes, make no comments, but ask questions. Look for trash, broken insulation on pipes, cigarette butts, leaking water, leaking air, used parts, broken equipment, inappropriate storage, etc (Figure 2).

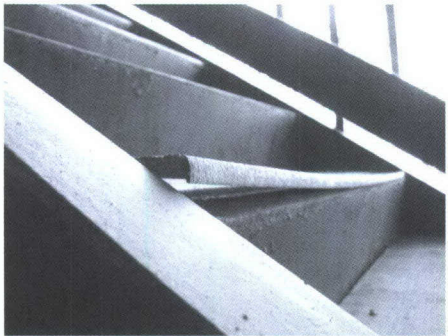
## Facilities Maintenance: Uncovering the "Black Hole"



A steam leak in an electrical area could result in a power outage, along with other failures and damage.



A water leak near a high voltage electrical panel has the potential to cause a deadly explosion.



A stair tread in need of immediate repair. The unrepaired tread is a serious trip hazard on a busy stairwell.



The stain indicates a leaking pipe in the ceiling. Such leaks can create the environment for growth of mold and mildew, some of which can be toxic.

Figure 2. Examples of potentially serious maintenance problems that can be easily identified by simply walking throughout a facility, including all of its mechanical rooms and spaces, and looking for such discrepancies.

Visit the roof to look for patches on the roof, places where people have left parts, trash, etc. Look for signs of rust on vents, etc. Ask the facility manager about the roof replacement cycle and if he has a plan to replace the roof, and a budget for the project. If he says no, ask what is the expected life of the roof. Go inside the facility and look for leaks, often indicated by dark spots in the ceiling tile. Look for anything that looks out of the ordinary as if it were your own home. Walking around the facility once a week with different leaders and the facility manager will bring big rewards for everyone.

### FACILITY ASSISTANCE AND ASSESSMENT SUPPORT TEAM: A WELL KEPT SECRET

*Supply Bulletin 8-75-11* requires MEDCOM to perform an inspection of each MTF every 36 months to ensure the MTF commanders and facility managers have an outside organization identify risks in their

MTFs (not nonmedical facilities).<sup>1</sup> The Facility Assistance and Assessment Support Team (FAAST) provides assistance, assessment, feedback, and oversight relative to the Facilities/Logistics Command Review Process.<sup>1(pp8-31-33)</sup>

The FAAST's services include the following:

- Provide comprehensive expertise to facility managers and commanders of MEDCOM MTFs in support of the facility management function.
- Support commanders against liabilities from outside agencies, such as the Occupational Safety and Health Administration, the Environmental Protection Agency, etc.
- Assist and train the facility management organization at the MTF level on how to meet and/or exceed the required standards, and to prepare for the Joint Commission and other accreditation surveys.

- Provide organized management tools to identify, prevent, or eliminate problem areas. Those tools include identification of systemic issues and problems to the facility directors.

### CONCLUSION

Establish a proactive maintenance program in your medical treatment facility where everyone is accountable for maintenance of the facility. Here are the steps I would follow:

1. Identify critical assets. Direct your deputies to establish a team to identify critical assets in your facility. These should include fire chief, safety officer, facility manager, the electrician who has been at the facility the longest, and maybe

someone from MEDCOM facilities engineering. Clinical staff must identify equipment that halts mission accomplishment if it fails.

2. Monitor metrics. Establish a facilities maintenance dashboard with trends posted somewhere in your office. Require that the same metrics are posted in the maintenance shop and in the facility manager's office.
3. Watch for "warning comments" (page 28).
4. Watch for "maintenance fallacies" (page 29).
5. Do unannounced walk-arounds. Seeing is believing.
6. Request a Facility Assistance and Assessment Support Team inspection of your facilities from the MEDCOM Facilities Group.

I have coauthored 2 books which deal directly and in greater detail with the topics discussed in this article, *Rules of Thumb for Maintenance and Reliability*

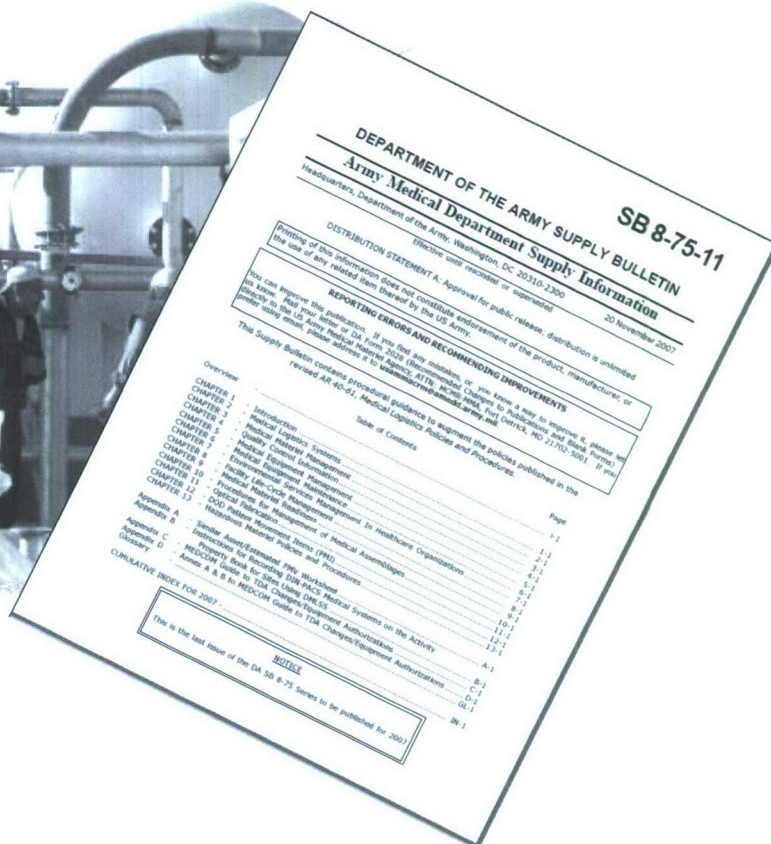
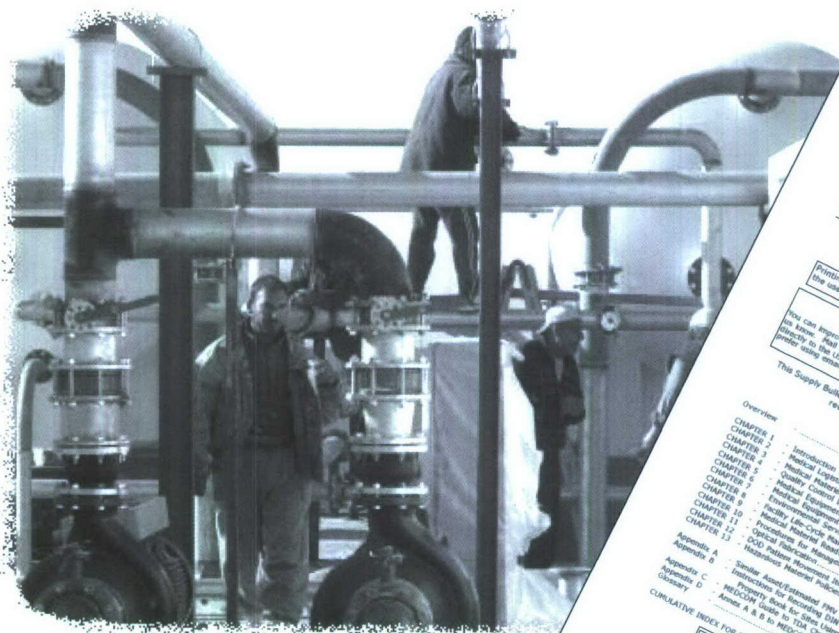
*Engineers*<sup>2</sup> (one chapter of this book is focused strictly on ranking assets based on risk) and *Lean Maintenance*.<sup>3</sup> Both books have lists of metrics which are used by some of the leading companies in the world to manage their maintenance.

## REFERENCES

1. *Department of the Army Supply Bulletin 8-75-11*. Washington, DC: US Dept of the Army; 20 November 2007: chap 8.
2. Smith R, Mobley RK. *Rules of Thumb for Maintenance and Reliability Engineers*. Burlington, Massachusetts; Elsevier: 2008.
3. Smith R, Hawkins B. *Lean Maintenance*. Burlington, Massachusetts; Elsevier: 2004.

## AUTHOR

At the time this article was written, MAJ Smith was Director of the Process Improvement Team, Army Medical Action Plan, Office of The Surgeon General, Alexandria, Virginia.



# ***Medical Care for Army Reserve and National Guard Soldiers in the Global War on Terror***

COL Susan Durham, AN, USA  
COL Anne Bauer, AN, USA

## **INTRODUCTION**

For the past 5 years the Army has been heavily engaged in operations in support of the Global War on Terror (GWOT) and has increased efforts to manage the health, welfare, and readiness of Reserve and National Guard Soldiers who are injured or become ill while serving in the line of duty. The Army has enacted programs to ensure care is available and provided for GWOT connected illness and injury, as well as injuries, illness, or disease incurred while in a nonmobilized active duty status. This article provides a brief overview of two of these programs, Medical Retention Processing 2 (MRP2) and Active Duty Medical Extension (ADME) respectively. The majority of this information is taken directly from the Warriors in Transition Consolidated Guidance issued by the Department of the Army.<sup>1</sup>

## **BACKGROUND**

The ADME program was established to place Reserve and National Guard Soldiers on orders to undergo medical care. This program is available to drilling Reserve Component Soldiers who have incurred a non-GWOT related injury. Historically, this program was managed by Headquarters, Department of the Army (HQDA) G-1 until October 2006. Applications were submitted to a medical policy team in G-1, who reviewed the packet and published the orders. After October 2006, program management was moved to a mobilization team. The policy oversight for the ADME program continues to be maintained at HQDA G-1. The Soldier submits an application packet through his or her unit to the mobilization team, located at the Army Human Resources Command in Alexandria, Virginia. The mobilization team reviews the packet to assure all information is complete. They forward the packet to a 3-person medical review board for evaluation.

The MRP2 program was established on 17 April, 2006 by the Assistant Secretary of the Army, Manpower and

Reserve Affairs, to provide an opportunity for demobilized Reserve and National Guard Soldiers who had been injured in GWOT to be placed on active duty orders for medical care and treatment. The Soldier's application process includes review by a medical review board.

## **OVERVIEW**

Both the MRP2 and ADME programs are designed to expeditiously, effectively, and compassionately evaluate and treat Army Reserve and National Guard Soldiers who have a line-of-duty incurred illness, injury, disease, or aggravated preexisting condition. A military medical authority must find that the Soldier has an unresolved line-of-duty (service connected) medical condition, meets program eligibility criteria, and voluntarily requests participation in either of the MRP2 or ADME programs. The programs are designed to provide ongoing, acute, interventional care to return the Soldier to retention status and back to duty with his or her respective Army Reserve or National Guard unit as soon as possible. If return to duty is not possible, the Soldier will be processed through the Army Physical Disability Evaluation System (PDES).

The programs apply to both inpatient and outpatient treatment.

## **MEDICAL RETENTION PROCESSING 2**

The MRP2 program provides for the temporary return to active duty of Army Reserve and National Guard Soldiers previously mobilized in support of GWOT. Under MRP2, Soldiers may voluntarily return to active duty specifically for medical evaluation and treatment, and, if necessary, processing through the PDES for injury or illness incurred or aggravated during a previous period of mobilization in support of GWOT.<sup>1</sup> To be eligible, the Soldier must submit an application through his or her current chain of command, and have documented, unresolved line-of-duty medical issues.

The Reserve Component Soldier has 6 months from the date of release from active duty to submit the application. The Soldier must remain a member of the Selected Reserves or the Individual Ready Reserve. For certain circumstances, HQDA G1 is authorized to grant exceptions to policy.<sup>1</sup> A medical review board will determine the Soldier's eligibility for MRP2.

The Soldier must be counseled by his or her unit on the MRP2 program and incapacitation pay before submitting an application to the program. The Soldier must also volunteer for recall to active duty for medical assessment and treatment. Orders are issued for 179 days and may be renewed, if medically indicated. A Soldier may decline MRP2 up to the time of publication of the MRP2 order. If the Soldier wishes to withdraw the application, he or she must sign a declination statement. He or she may decline MRP2 without prejudice prior to the publication of orders.

### **ACTIVE DUTY MEDICAL EXTENSION**

The ADME program is designed to place Army Reserve or National Guard Soldiers on voluntary temporary active duty for evaluation or treatment of line-of-duty service-connected medical conditions or injuries, and return them to duty within their respective units as soon as possible. If return to duty is not possible under ADME, the Soldier will be processed through the Army PDES.<sup>1</sup>

The medical condition must have been incurred or aggravated while in an Individual Duty for Training or nonmobilization active duty status, and the requirement for medical care must extend beyond 30 days. The medical condition must prevent the Soldier from performing his or her military specialty duties within the confines of a physical profile (DA Form 3349) issued by a military medical authority. A medical review board will determine the Soldier's eligibility for ADME.

The Soldier must be counseled by his or her unit on the ADME program and incapacitation pay before submitting an application to the program.

### **APPLICATION PROCESS**

The application process is similar for both programs, and has both administrative and medical channels. The Soldier's unit submits application packets via FAX to the Army Human Resources Command in Alexandria,

Virginia. The packet is reviewed for administrative eligibility and completeness. If administrative criteria are met, the packet is sent to the ADME/MRP2 Medical Review Board for medical review and an eligibility decision. The ADME/MRP2 Medical Review Board is an electronic board of 3 members representing the National Guard Bureau, Army Reserve, and the Office of The Surgeon General/US Army Medical Command, respectively. All board members must be licensed providers (physician, nurse practitioner, or physician's assistant). One member must be a physician, and there must be one member with the rank of colonel.

Each packet is reviewed by the board to determine if sufficient documentation is included to make a sound clinical decision to return the Soldier to active duty. Decisions are made using professional clinical judgment in accordance with policy guidelines/criteria set forth in the Warriors in Transition Consolidated Guidance.<sup>1</sup> Two of the board members must recommend approval before a Soldier is offered ADME or MRP2 orders.

If a Soldier is not recommended by the board, he or she may resubmit or appeal the decision. Resubmission is a request by the Soldier to have the original packet reviewed again by the board, with the inclusion of additional clinical documentation and information. Appeal is a request by the Soldier to have the original packet reviewed by a higher level authority. The packet will include all originally submitted documentation only. It may not include any additional clinical or medical information.

Key components for medical review are a definitive treatment plan, which includes diagnosis and prognosis, and a specific treatment plan which may include physical therapy, surgery, rehabilitation, medications, etc. The packet must also include an approved Statement of Medical Examination and Duty Status (DA Form 2173). A Soldier whose applications is already in the medical evaluation board process is not usually brought into the ADME or MRP2 programs until the board action is complete.

### **CONCLUSION**

The ADME and MRP2 programs continue to evolve and be refined as the needs of the Soldiers and the Army emerge. Never before has our military been faced with the numbers of ill or injured Reserve Component Soldiers, or the severity and long-term

## Medical Care for Army Reserve and National Guard Soldiers in the Global War on Terror

consequences of their wounds. Wounds that can be seen are often more easily addressed and treated. Nonvisible wounds are a much greater challenge, and are sometimes not immediately evident. This is the greatest challenge in treating the Army Reserve and National Guard Soldiers. With ongoing dedication and vigilance, the Army will continue to meet the ever changing and challenging needs of these Soldiers.

---

### REFERENCE

1. *Warriors in Transition Consolidated Guidance*. Washington, DC: US Dept of the Army; December 2007.

---

### AUTHORS

COL Durham is Deputy Director, ADME/MRP2, Warrior Transition Office, Warrior Care and Transition Directorate, Office of The Surgeon General, Falls Church, Virginia.

COL Bauer is Deputy Surgeon, Office of the Chief of the Army Reserve (Forward) in Washington DC.



# ***The Brooke Army Medical Center Experience with a Focused Medication Reconciliation Program***

CPT Jesse W. Neeley, MC, USA  
Sara J. Pastoor, MD, MHA

The mission of the Warrior Transition Battalion is to provide the best possible care to Soldiers as they make the transition to civilian life or undergo rehabilitation to return to fit-for-duty status. All Warrior Transition Battalion patients have medical conditions serious enough to potentially prevent them from performing their military duties and therefore inherently require and deserve the best medical care and oversight the Army Medical Department has to offer. To do so, the Commanding General of Brooke Army Medical Center assembled a medication reconciliation team tasked with auditing medication risk for all Brooke Army Medical Center Warriors in Transition.

The medication reconciliation team consisted of 3 physicians, 3 clinical pharmacists, and support staff. The project took place over a month, during which a pharmacist and physician performed face to face medication reconciliation for every Warrior in Transition, eliminated unnecessary medications and simplified medication regimens, updated the patient's electronic medication record, screened for substance abuse, educated patients about their medications, and ensured the primary care manager received a final, updated medication list. The process is illustrated in Figure 1. A number of medication discrepancies and issues were identified, and it became evident that there was room for implementation of new processes and programs in order to decrease medication-related risk and improve patient safety.

## **MEDICATION RECONCILIATION PROCESS**

Over 500 Warriors in Transition at the Brooke Army Medical Center were seen for medication reconciliation. Each patient brought all prescription medications, herbals, over the counter medications, and supplements in his or her possession to the

appointment. Patients were asked about the quality of their pain control, existence of a sole provider, adverse drug reactions, prescription medication abuse, alcohol abuse, illegal "street" drug use, and any knowledge or participation in trafficking or diversion of prescription or street drugs. Excess or discontinued medications were collected and disposed of or returned with tracking receipts to the pharmacy (Figure 2). Patients were educated about their medications and each patient was given a pocket card list of all his or her current medications to carry and bring to future appointments. Modifications to the existing treatment plan were avoided unless absolutely necessary.

Results generated 114 referrals: 4 to the Army Substance Abuse Program, 17 to primary care managers to address complaints of uncontrolled pain, 24 to primary care managers for lack of a sole provider, and 69 to primary care managers for miscellaneous concerns.

## **RESULTS**

The work of the medication reconciliation team identified several issues:

- The majority of patients had incorrect medication profiles in their electronic medical records.
- Many Warriors in Transition were in possession of medications they did not need or were no longer taking, to include controlled substances.
- The process for the return or disposal of excess medication was unclear to both the patients and the health care providers.
- There were also reports of pill or "pharm parties" and medications being used as poker chips. A number of the WTs also reported witnessing the

## The Brooke Army Medical Center Experience with a Focused Medication Reconciliation Program

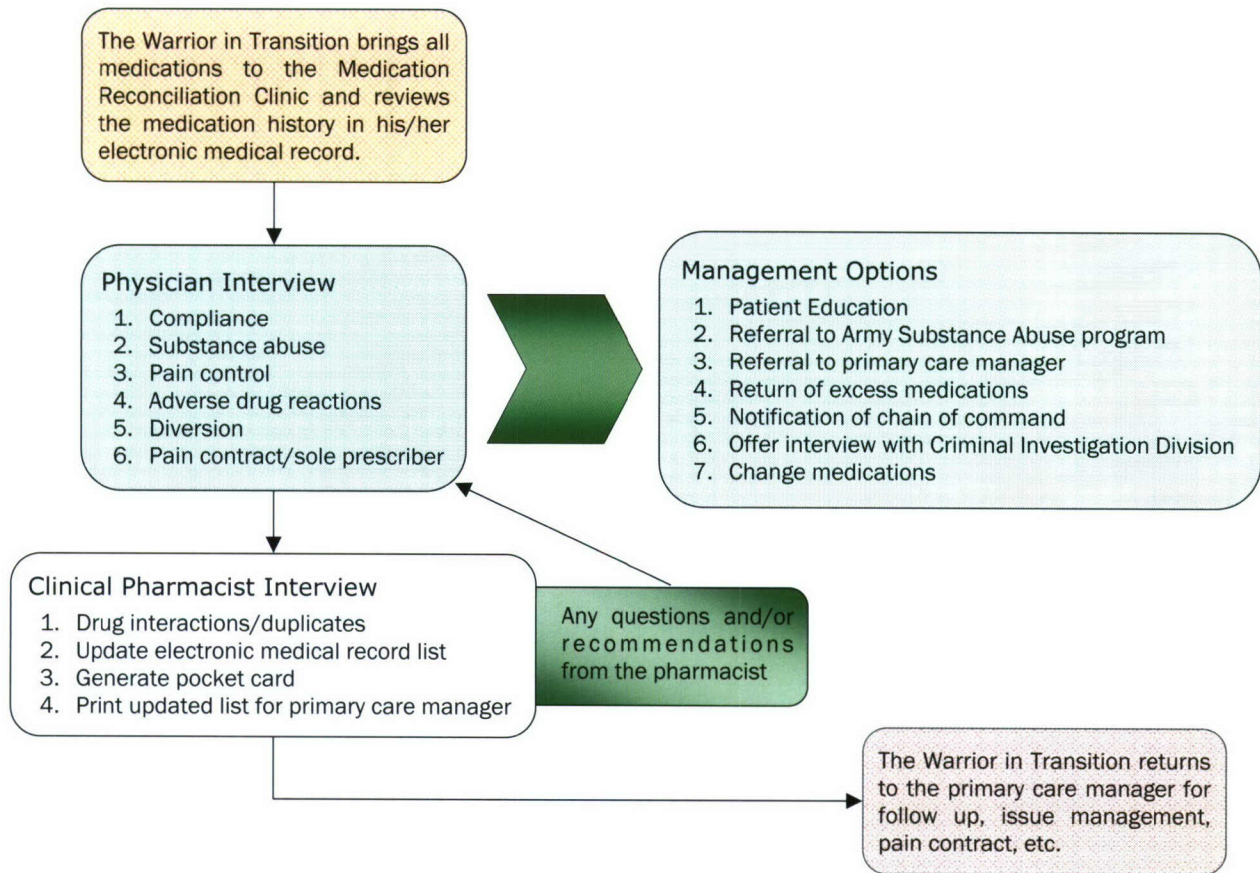


Figure 1. The process of the Brooke Army Medical Center Medication Reconciliation Program.



Figure 2. Excess medications returned to the Brooke Army Medical Center pharmacy as a result of the medication reconciliation team's actions.

trading, sharing, and selling of controlled prescription medication as well as illicit drugs within the Warrior Transition Battalion barracks and lodging facilities. Multiple Soldiers reported witnessing the use and sale of cocaine, marijuana, and mushrooms within the Warrior Transition Battalion barracks. One individual admitted to personally using street drugs while assigned to the Warrior Transition Battalion. This individual described at length the subculture of illicit drug users in the Warrior Transition Battalion. The same set of individuals using street drugs was reported as also using prescription medications and/or alcohol in combination. Warriors in Transition were offered the opportunity to discuss what they knew with the Army Criminal Investigation Division, but all declined. The Warrior Transition Battalion leadership was informed of the reports in a general manner, but no identification of the WT's making the reports was provided to the chain of command.

This project highlighted a clear medication-related risk for Brooke Army Medical Center's Warriors in Transition, and provided an opportunity to increase situational awareness for all members of the WTU triad. The issues ranged in severity from mere process inefficiency to flagrant health hazards and illegal activity. Recommendations to improve came from

many sources, including the Warriors themselves, and involved process improvement, enhanced programs, and greater focus on the screening and mitigation of medication-related risk. In response, Brooke Army Medical Center has implemented an aggressive and thorough ongoing medication reconciliation program for all Warriors in Transition. The pharmacy has developed a user-friendly medication turn-in process. The sole provider program is receiving heightened attention and emphasis. The Warrior Transition Battalion chain of command has taken steps to increase unit activities intended to fight boredom. New educational programs are increasing awareness for both Warrior Transition Battalion patients and staff regarding medication safety, self and buddy-referral for help with substance abuse, and unit policies and guidelines.

---

#### AUTHORS

CPT Neeley is the Medication Reconciliation Specialist in the Warriors in Transition Clinic, Brooke Army Medical Center, Fort Sam Houston, Texas.

Dr Pastoor is Chief, Department of Family and Community Medicine, Brooke Army Medical Center, Fort Sam Houston, Texas.



# *The Enhanced Reintegration Action Plan: The Madigan Experience*

LTC Karl Bolton, MS, USA  
1LT Sherri Zimmerman, USA  
Ms Ellen Bloom, MSW, LCSW  
CPT Michael Hunter, USA  
MAJ Kenneth West, USA  
LTC Ali Hunt, AN, USAR  
MAJ Michael Lawrence, USA

## **BACKGROUND**

The Army Medical Action Plan, implemented in June of 2007, directed broad, sweeping changes to ensure wounded and injured warriors receive top priority for care services, housing, and command support. As a result of these directives, Warrior Transition Units (WTUs) were established to provide command and control, primary care, case management, and transition support services. The formation of WTUs addressed a void in existing organizational structures and resources for Warriors in Transition (WTs), those Warriors who have unique requirements to either prepare them for return to the fighting force, or assist them in transitioning to serve in their communities.

The Fort Lewis Garrison and its subordinate Joint Mobilization Brigade had developed the Reintegration Action Plan (RAP) program for Fort Lewis Soldiers on Medical Hold status in January 2007. The program matched Soldier input regarding future goals with resources available. In August of 2007, as part of the Madigan Army Medical Center (MAMC) implementation of the Army Medical Action Plan, the Warrior Transition Battalion built directly upon the success of the RAP program to create a timeline for the projected care plan, use of available resources, and meeting the goals of each Warrior. It also made the process visual and truly multidisciplinary. The *Enhanced* Reintegration Action Plan (ERAP) became the foundation for the establishment of the WTU structure and the Comprehensive Care Plan\* process at Madigan and Fort Lewis.

Many WTs can ably serve in uniform upon release from the WTU. However, some can no longer serve as a Soldier due to their injury or illness. This is

particularly troubling if the Warrior is a National Guard or Reserve Component Soldier who must return to their community and reenter civilian life. As a result, WTUs must look beyond the primary mission of healing toward facilitating the transition process for each Warrior. The ERAP is designed to address this transition period, engaging the Warrior in developing goals and measures of success for their tenure in the unit and beyond. It consists of a multidisciplinary support team: the Warrior, the Warrior's Family, and tailored support agencies working in concert to achieve the established goals. Warrior care plans and other goals are put on a milestone (eg, Gantt) chart with input from social work, case managers, occupational therapy, and other team members. More than 600 Warriors in Transition have benefited from this comprehensive approach at MAMC. The successful implementation of ERAP and its integration directly into the Army's Comprehensive Care Plan concept can serve as the model for other commands interested in adopting ERAP within their WTUs.

## **PROGRAM TENETS**

The ERAP process seeks to interactively engage the Warrior in "next steps" planning. It is an individualized, goal driven, visual, interactive, digitized process that maps out care plan and life goal milestones. Designed to accommodate Warriors suffering from mild traumatic brain injury and post traumatic stress disorder along with other types of injury, the process uses common resources such as white boards and computers to establish, manage, and facilitate goals set by the Warrior.

The key tenets of the ERAP:

1. Each WT has a multidisciplinary team. The core stakeholders of the ERAP program are resources

---

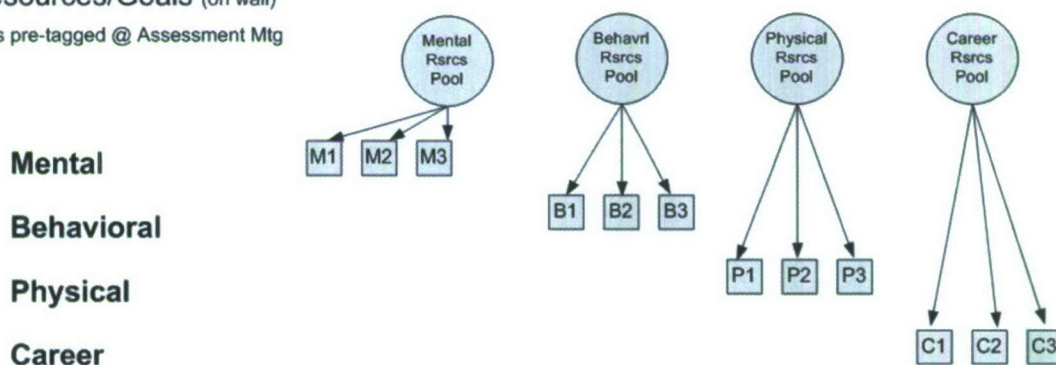
\*See related article on page 8

Function	Responsibility: Activity	Days After Reporting to WTU
<b>Inprocessing</b>	<b>Squad Leader:</b> Introduction <b>Licensed Clinical Social Worker/Nurse Case Manager:</b> Administer intake questionnaire	0-1
<b>Assessment</b>	<b>Nurse Case Manager, Primary Care Manager:</b> Plan of Care <b>Multidisciplinary team</b> led by <b>Licensed Clinical Social Worker</b> assess WT* responses on intake questionnaire. Team identifies goals with projected achievable dates. Sets date for ERAP goal-setting Scrimmage with unit.	1-7 8-14
<b>ERAP Goal-setting Scrimmage</b>	<ul style="list-style-type: none"> <li>Visualization of goal-setting process using white board medium</li> <li>ERAP<sup>†</sup> Team, WT, and Family set additional goals</li> <li>Goals/milestones are placed on a timeline</li> <li>Results are placed in digital format for archives/ease of use</li> </ul>	30
<b>Follow-up</b>	Squad Leader and ERAP team: Follow-up plan execution.	Every 30 days or as needed

Figure 1. Enhanced Reintegration Action Plan<sup>†</sup> execution timeline for the Warrior in Transition\* after he or she reports to the Madigan Army Medical Center Warrior Transition Unit.

### Step 1: \*Resources/Goals (on wall)

\*Some resources pre-tagged @ Assessment Mtg



### Step 2: Storyboarding (on whiteboard)

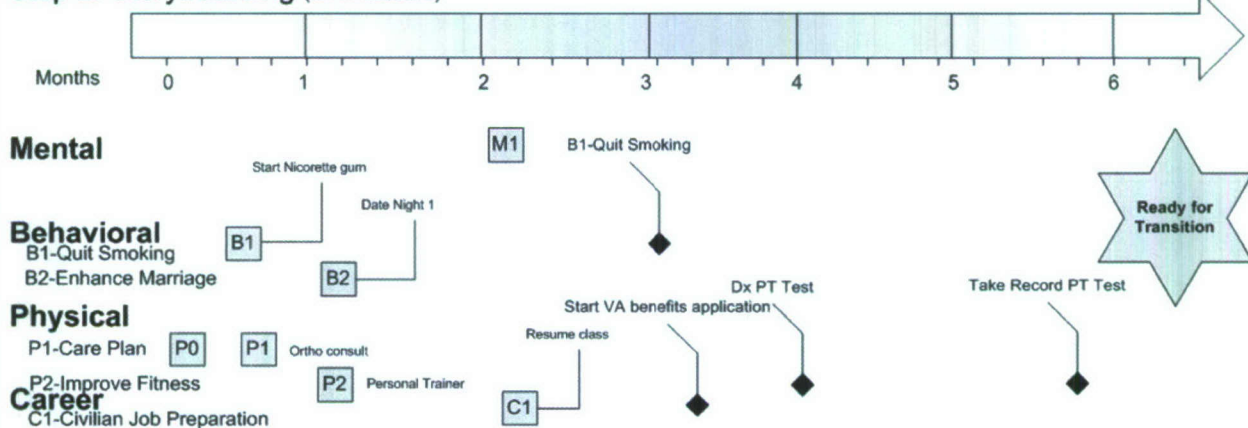


Figure 2. Example of an Enhanced Reintegration Action Plan Scrimmage storyboard.

## The Enhanced Reintegration Action Plan: The Madigan Experience

of the existing WTU Table of Distribution and Allowances,\* and include licensed independent clinical social workers, nurse case managers, the primary care manager, occupational therapists or technicians, the squad leader, the WTs themselves, and their Families. Other stakeholders on the team include the Soldier and Family Assistance Center team dedicated to each WTU, nongovernmental support organizations, physical therapists, and fitness experts.

2. A single, electronic, intake questionnaire is completed by the WT during arrival processing. This questionnaire is a compilation of questions from each discipline which cover all key appraisal indicators necessary for the ERAP Team to establish initial care, mental health, career, and life skills plan/goals for each WT.
3. Visualization of the goal-setting process with transference to digital medium.
4. A formal work, vocational rehabilitation, and education/training program tailored for each WT consistent with their care plan.
5. Periodic review of milestone accomplishment.

### ERAP EXECUTION

The WT's involvement with ERAP at MAMC starts with the arrival processing (inprocessing). As mentioned above, each WT completes a computerized intake questionnaire which populates the ERAP database with basic information on the Warrior, and develops a "hot sheet" of answers for the social work section of the unit as a primer for the initial ERAP scrimmage (goal-setting meeting). The goal-setting process, roughly 30 days after arrival in the unit, assists the WT with linking internal and external resources by bringing the full expertise of the multidisciplinary team onboard to help guide the process. Each goal within functional domains is published on a white board as a milestone. Subsequent tracking of goal accomplishment is managed by the whole team with the squad leader serving as the primary manager of the process. Goal-oriented management of each WT's tenure in the unit has

proven to maximize utilization of resources and provide a template for that Warrior's key events within the unit. The nominal ERAP process timeline at MAMC is illustrated in Figure 1.

### Inprocessing

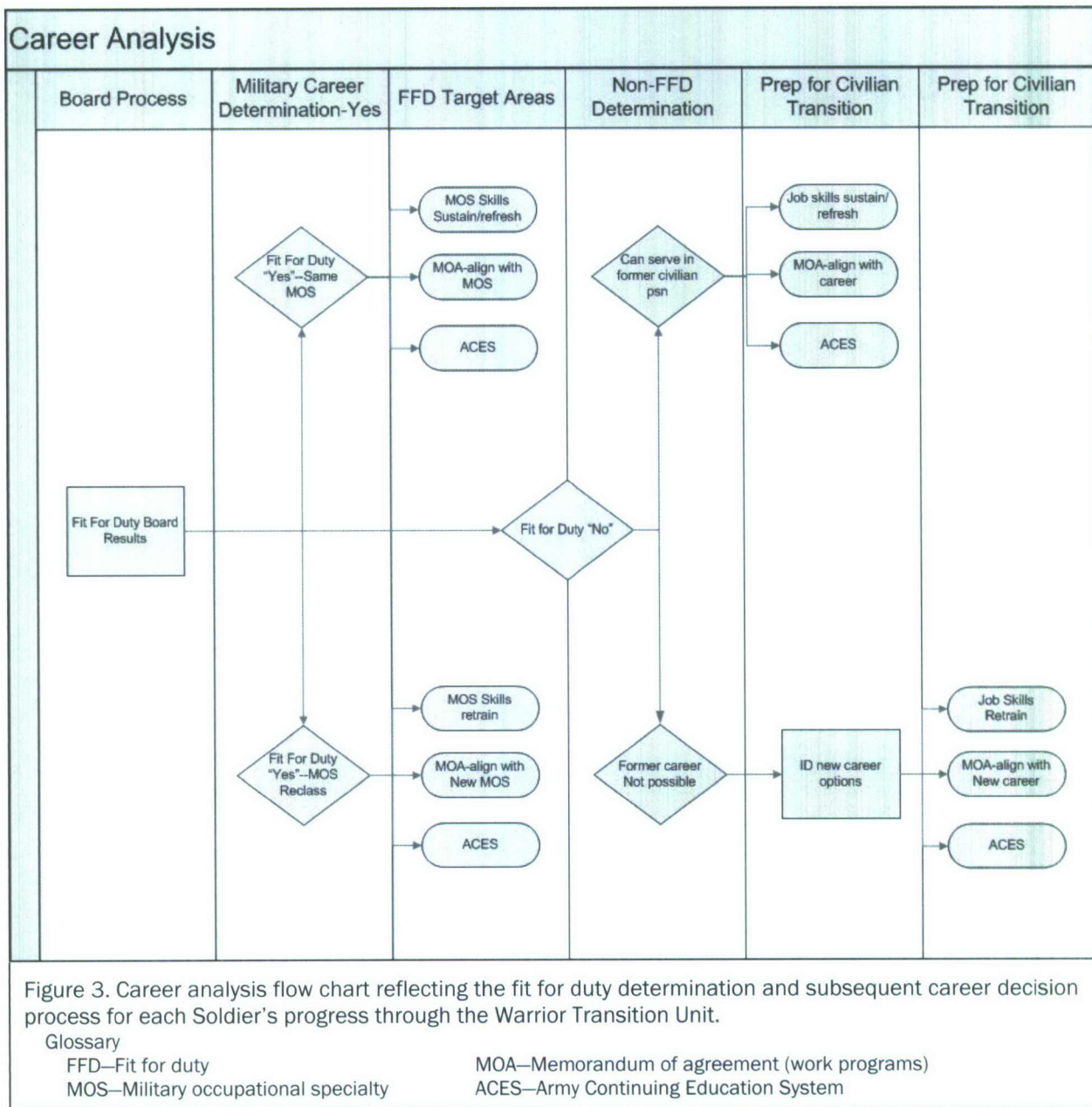
ERAP is embedded in the MAMC WTU's inprocessing phase. Upon arrival in the unit, the WT's squad leader educates the Warrior on the ERAP program. The assigned nurse case manager or the WT's dedicated licensed clinical social worker establishes an appointment to complete the intake questionnaire. Also during inprocessing, the nurse case manager assigned to the WT and their primary care manager complete the initial care plan for that Warrior. The completed questionnaire and care plan are reviewed by the Warrior's multidisciplinary ERAP team. The team establishes a date for the ERAP goal-setting "scrimmage," a meeting in which the team, the Warrior (and Family if available), and the squad leader review goals set by the team and coach the WT to establish goals of their own.

### Goal-Setting Scrimmage Delivers All Elements

The ERAP scrimmage is the heart of the program. It produces a visual record and timeline of goals, synchronized parallel to care plan key events so that the Warrior will understand all aspects of what to expect while in the WTU, and how to reach the next phase of their life.

Shortly after the WT joins the unit, the WT's care plan, developed by the nurse case manager and primary care manager, is coupled with recommended goals from the rest of the ERAP team based on the intake questionnaire. The care plan and the suggested goals are placed on a large wall/white board. The goals are grouped by domains, such as career, behavioral, etc. The WT is coached through the process to identify their personal goals, with the ERAP team's input. These goals are then put on a large, digitized white board across a timeline, in a "storyboard" fashion (see Figure 2), with participation of the entire ERAP team, the WT, and the Family. The visual display of goals across the domains with associated milestones reinforces the methodology and garners WT acceptance of their own transition plan. Digitizing the results of the goal-setting meeting allows rapid reset of the goals and milestones for periodic review, as well as

\*Prescribes the organizational structure, personnel and equipment authorizations, and requirements of a military unit to perform a specific mission for which there is no appropriate table of organization and equipment.



facilitating the update of changes to the plan as they occur.

The process has proven to be successful at reenergizing even those Warriors who have extended lengths of stay in the MAMC WTU. One Warrior had spent more than 14 months in the Fort Lewis Medical HoldOver company and then the Warrior Transition Battalion before he was introduced to the ERAP scrimmage process. At the end of the session he stated, "For the first time since being in the unit I can call my wife and tell her when to expect me back home."

The process accommodates both those Warriors expected to return to duty (RTD) as well as those who will not be able to continue service in uniform (see Figure 3). For those who will RTD, ERAP establishes a plan to ensure military occupational specialty skills are retrained and sustained. Towards the end of the Warrior's expected stay in the MAMC WTU, Army Warrior Tasks, weapons qualifications, and a diagnostic physical fitness test can be administered. The WTU's goal is to return each Warrior to the force in the highest condition of deployable readiness as possible. For those who cannot continue to serve in

Lines of Effort	ERAP Processes		
	Tier 1 Difficulty	Tier 2 Difficulty	Tier 3 Difficulty
<b>Maximize ERAP Utilization</b>	Percentage of WTs with ERAP-S	Number of remote WTs with ERAP resources	Number of remotes with ERAP plan
	Number of ERAP-S per week		
	Number of ERAP-S involving Families	Percentage applications for VBA	
<b>Streamline ERAP processes</b>	Average time/Scrimmage	Number of timelines digitized	
	ERAP-S within 30 days of inprocessing		
	Reduction of clinic no-shows	Number of WTs filling FLW BMM slots	Percentage of MOSs which match to work
<b>Provide meaningful work opportunities</b>	Number of WTs with MOA or ACES		
<b>Warrior Outcomes</b>			
<b>Promote personal and professional growth</b>	Number of WTs enrolled in ACES	WT GPA improvement	Number of WTs with certifications
	PW satisfaction survey scores		
<b>Provide transition safety net</b>	Number of ERAP referrals to SFAC	Number of non-RTD WTs with job interviews	Number of WTs with job offers
		Number with first VA appointment scheduled while in WTU	
<b>Improve Warrior health and fitness</b>	Length of stay in unit	Reduction in WCC utilization rate	Reduced suicidal events
	PW self-score on improved health		
	Percentage RTD in current or new MOS	Number & percentage of WTs returned to parent unit	Number returned to duty with basic AWT skills
<b>Support the Global War on Terror</b>	Number RTD in current MOS		
<b>Support or improve unit METL</b>	Care/support/transition tasks "P"	Care/support/transition tasks "T"	
<b>Improve Family well-being</b>	Number of ERAP-S with Family referrals	Reduced rate of domestic violence	

Figure 4. An example of the Enhanced Reintegration Action Plan Lines of Effort metrics model.

Glossary

ACES – Army Continuing Education System  
 AWT – Army Warrior training  
 BMM – borrowed military manpower  
 ERAP – Enhanced reintegration action plan  
 ERAP-S – ERAP goal-setting scrimmage  
 FLW – Fort Lewis, Washington  
 GPA – grade point average  
 METL – mission essential task list

MOA – memorandum of agreement (work programs)  
 MOS – military occupational specialty  
 RTD – return to duty  
 SFAC – Soldier and Family assistance center  
 VA – US Department of Veterans Affairs  
 VBA – Veterans Benefits Administration  
 WCC – Warrior care clinic  
 WT – Warrior in Transition

uniform, ERAP tailors support services, introduces Army Continuing Education System resources, initiates Department of Veterans Affairs enrollment and benefits processing, and presents other Army and civilian transitioning programs. The milestone timeline/storyboarding approach allows Warriors to visualize when each major task should occur, and prepares them with a plan of action.

## ERAP METRICS: TRACKING PROGRAM PERFORMANCE AND EFFECTIVENESS

Like other initiatives, it is important to gauge the ERAP program's performance and effectiveness. Using a line-of-effort (LOE) model, critical tasks of the ERAP program can be tracked. Each LOE has specific metrics, segmented into Measures of Performance and Measures of Effectiveness. Measures of Performance assess the implementation of ERAP processes, while Measures of Effectiveness address Warrior outcomes.

The LOEs of Measures of Performance include:

- Maximize ERAP utilization

- Streamline ERAP processes
- Provide meaningful work opportunities

Metrics within these LOEs could include tracking the number of scrimmages executed, the percentage of Warriors with an ERAP plan in place, and similar statistical measures.

The LOEs of Measures of Effectiveness include:

- Promote personal and professional growth
- Provide transition safety net
- Improve Warrior health and fitness
- Support the Global War on Terror
- Sustain or improve the WTU mission essential task list
- Improve Family well-being

Metrics within these LOEs could include, for example, the Warrior's self-assessment of health status since enrollment in the program, the number of Warriors enrolled in the Army Continuing Education System

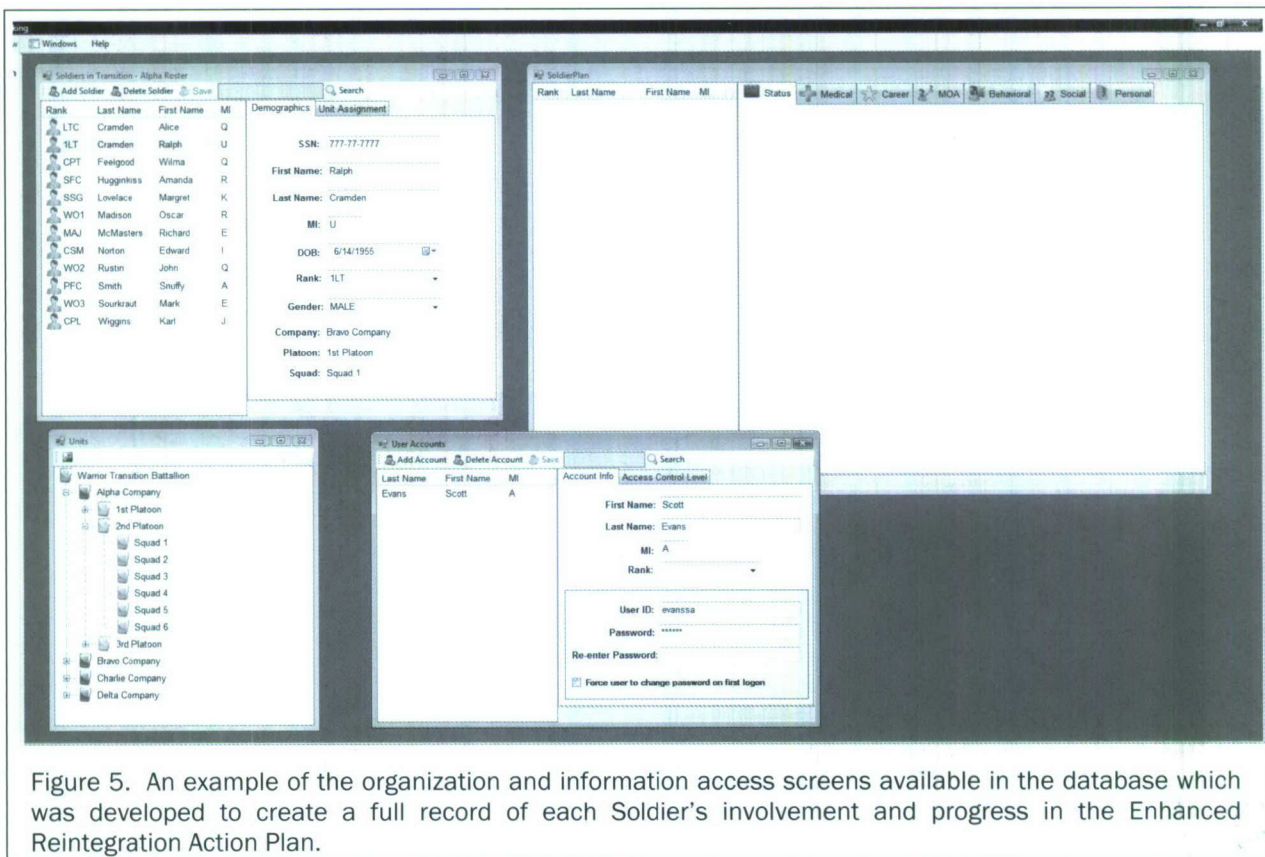


Figure 5. An example of the organization and information access screens available in the database which was developed to create a full record of each Soldier's involvement and progress in the Enhanced Reintegration Action Plan.

## The Enhanced Reintegration Action Plan: The Madigan Experience

who have had improvement in grade point average, and the percentage of Warriors who are returned to their originating unit. Figure 4 illustrates the ERAP LOE approach to tracking and evaluating a program's effectiveness.

### ERAP EVOLUTION: THE WAY AHEAD

The complexity and comprehensiveness of ERAP dictate that technology enablers sustain an effective program. While many project management software programs can emulate the timeline aspect of the goal-setting scrimmage, those programs are often not user friendly and can be cumbersome to maintain. They also do not provide effective assistance in tracking metrics. As a result, a relational database was developed locally at the Madigan Army Medical Center to present milestones in useful timelines, and create a full record of each Warrior's ERAP involvement. The database allows quick entry of Warrior demographics and each established goal or milestone, and tracks execution of each milestone. An example of the database pages is shown in Figure 5. Data mining allows extraction of overall program measurement data which can be sorted by various demographics to identify gaps in execution of the ERAP.

Many Warriors are assigned to WTUs which are not physically located at their respective installations. This presents a problem: how do WTUs remotely provide transition services to Warriors? The future could involve the use of telehealth technologies, with each Warrior using a donated laptop and a suite of software and peripherals to allow remote execution of the multidisciplinary team's ERAP goal-setting scrimmage. The remote execution of ERAP ensures that all assigned Warriors in Transition have access to the same benefits as those on the installation. It will also facilitate, in a more meaningful way, the interaction of the Warrior, the Family, the assigned case manager, squad leader, and primary care manager.

### CONCLUSION

The experience of the Madigan Army Medical Center WTU validates the Enhanced Reintegration Action Plan as a comprehensive approach to maximize each WT's tenure in the WTU. The program formalizes

execution of the entire WTU mission essential task list. MAMC's experience is repeatable across WTUs in the Army Medical Command using the existing WTU/Warrior Transition Battalion and Soldier and Family Assistance Center structures, laptops, and regular white boards or a blank wall. The multidisciplinary team creation of a unique ERAP plan for each WT should be embedded in unit standard operating procedures. As a result, productivity will be increased for the entire ERAP team because its role in the WTU is clearly defined, and the use of a single, combined intake questionnaire reduces duplication of efforts within the ERAP team. ERAP provides a clearly understood and sustainable program for integrating internal and external resources and agencies to support Warriors and their Families. ERAP participants at the MAMC WTU have strongly recommended that this program be required for all Warriors in Transition—it has empowered each Warrior to take charge of his or her own transition plan, and has provided the assistance they need to serve in a greater, more rewarding capacity upon their return to service, or release into civilian life.

---

### AUTHORS

LTC Bolton is Commander, Warrior Transition Battalion, Madigan Army Medical Center, Fort Lewis, Washington.

1LT Zimmerman, an Adjutant General Corps officer, is Commander, Bravo Company, Warrior Transition Battalion, Madigan Army Medical Center, Fort Lewis, Washington.

Ms Bloom is Chief, Warrior Transition Battalion Social Work Clinic, Madigan Army Medical Center, Fort Lewis, Washington.

CPT Hunter, an Armor officer, is Assistant Operations Officer, Warrior Transition Battalion, Madigan Army Medical Center, Fort Lewis, Washington.

MAJ West, a Finance officer, is ERAP Program Manager, Warrior Transition Battalion, Madigan Army Medical Center, Fort Lewis, Washington.

LTC Hunt is Chief, Clinical Operations, Warrior Transition Battalion, Madigan Army Medical Center, Fort Lewis, Washington, and Senior Case Manager for the Western Regional Medical Command.

MAJ Lawrence, an Intelligence officer, is Executive Officer, Warrior Transition Battalion, Madigan Army

# Offering Hope for our Wounded Warriors: An Overview of the Womack Army Medical Center Pain Medicine Clinic

MAJ Thomas Weber, MC, USA  
MAJ Anthony Dragovich, MC, USA

Chronic Pain is a disease state that is just now being recognized as a significant independent clinical entity. Unmitigated chronic pain can be as destructive as any chronic medical condition. Pain is not a monolithic entity such as a fracture or deficiency of some essential nutrient. Pain is, rather, a concept used to focus and label a group of sensations, thoughts, emotions, and behaviors. Since there are many facets to pain, it should be obvious that no single treatment is available in the majority of cases.

Our experience with Soldiers involved in our current conflict is consistent with injuries that have been reported since the 16th century. The French military surgeon Ambrose Pare first described phantom limb pain, phantom sensations, and stump pain, all of which we regularly see today.<sup>1</sup> The American civil war surgeon, S. Weir Mitchel, who coined the term “causalgia,” stated:

Perhaps few persons who are not physicians can realize the influence which long-continued and unendurable pain may have on both body and mind.... Under such torments the temper changes, the most amiable grow irritable, the bravest Soldier becomes a coward, and the strongest man is scarcely less nervous than the most hysterical girl. Nothing can better illustrate the extent to which these statements may be true than the cases of burning pain, or, as I prefer to term it, Causalgia, the most terrible of all tortures which a nerve wound may inflict.<sup>2</sup>

Dr Mitchel poignantly illustrated the physical and emotional toll that is extracted by chronic, unremitting pain. Surprisingly however, the most common causes of chronic pain during our recent and current military conflicts are still ordinary conditions, such as accidents and musculoskeletal complaints, with low back pain accounting for over 50% of presenting pain complaints in Soldiers from Operations Iraqi Freedom and

Enduring Freedom.<sup>3-7</sup> Consequently our patient population is composed of polytrauma patients as well as patients that are typically seen in civilian practice, where 17% of patients in an average primary care practice present with chronic pain complaints.<sup>8</sup>

Pain theory has evolved over time from Descartes' proposed theory in 1634, to the gate control theory of Melzak and Wall in 1964, to our current understanding of pain. Descartes' theory stated that pain is transmitted through a single channel from the skin to the brain. This theory has directed the study and treatment of pain for 330 years and unfortunately is still described in some physiology and neuroscience textbooks as fact rather than theory. It is also the predominate pain paradigm of patients. Melzak and Wall's description of the gate control theory<sup>9</sup> rejuvenated pain study and has led to our current understanding of the complex neural-humeral processing that take place at 3 distinct locations as an impulse travels from its origin to the brain. At each level—the periphery, the spinal cord, and the supra-spinal levels (brainstem and cortex)—the pain impulse can be augmented or diminished.<sup>10</sup> Therefore, effective treatment must act at one or more of these levels.

The supra-spinal level is the most complex and least understood region. In spite of this, any program or treatment course must take into account the complex subjective dimensions of pain that originate in the brain, described as the

- sensory-discriminative (where and what the pain “feels like”),
- affective-motivational (how the pain makes you feel/what that feeling makes you do), and
- cognitive-evaluative dimensions (what do you believe is the etiology of your pain).<sup>11</sup>

## **Offering Hope for our Wounded Warriors: An Overview of the Womack Army Medical Center Pain Medicine Clinic**

The emotional/cognitive aspects of pain must be recognized and treated appropriately for all patients with chronic pain, but it is even more paramount in our patient population, many of whom also have post traumatic stress disorder (PTSD) and/or traumatic brain injury (TBI).<sup>12</sup> It is well recognized that patients with TBI and PTSD have heightened experiences of pain, impaired coping mechanisms caused by catastrophic interpretations of pain, elevated anxiety levels, and diminished attentional control which impairs the use of cognitive-behavioral therapies.<sup>13-16</sup>

Womack Army Medical Center (WAMC) recognized the need for excellent pain treatment for our Soldiers and now boasts a state of the art interventional pain clinic that closely collaborates with world renowned pain medicine physicians at the Johns Hopkins School of Medicine in order to provide all of our Soldiers with the best possible medical care. Many Soldiers with acute or subacute pain conditions are treated. The vast majority of patients who receive treatment remain on active duty. This is indeed a testament to the quality and character of our Soldiers. The remainder of this article, however, will focus on the complex patient with chronic pain due to difficult-to-treat conditions.

In response to this complexity, the WAMC Warrior Transition Battalion (WTB) has been instrumental in coordinating the care for these wounded warriors. Given the enormous breadth of pain etiologies, ranging from polytrauma to more mundane but still potentially debilitating conditions such as low back pain, it is not surprising that simple algorithmic approaches to treatment are not successful. Some conservative chronic pain treatments have good evidence of efficacy, such as cognitive-behavioral therapy, aerobic exercise, spinal manipulation, and interdisciplinary rehabilitation.<sup>17</sup> Often these treatments must be combined in a cohesive program with interventional and/or medical treatments to achieve optimal success.<sup>18,19</sup> The WTB is the structural center of our multidisciplinary approach.

The pain medicine clinic provides interventional and medical treatments to patients who are already involved in other multidisciplinary pain treatment/rehabilitation programs, as well as recommendations for multidisciplinary treatment regimens. Early identification and treatment of pain are known to reduce the incidence and severity of chronic pain and therefore conserve healthcare resources.<sup>20</sup> Early,

effective intervention is key to successful long-term outcomes. We are working to become even more effective as we initiate our pain surveillance program which is reviewed later in this article.

Successful pain treatment, even if short term, improves affective dimensions of pain and improves the efficacy of all other treatment modalities. The most stunning success was a Soldier with complex regional pain syndrome (ie, Dr Mitchel's causalgia<sup>2</sup>) who was treated with a spinal cord stimulator (SCS) implantation. There is good evidence for the efficacy of this treatment for complex regional pain syndrome,<sup>21-23</sup> as well as a recent trial of 10 consecutive Marine Corps and Navy personnel who obtained greater than 80% pain relief with SCS implantation.<sup>24</sup>

The Soldier had failed conservative therapy and common interventional techniques. His pain was debilitating with marked effects on mood, sleep, and basic daily function, however, he greatly desired to continue on active duty and remain deployable. He had a successful trial and the device was implanted. To date, he is now the only Soldier known to be deployed with a SCS. Overall, he reports very few limitations and his activities include push-ups, sit-ups, running, weight lifting, scuba diving, hiking, backpacking, ruck-marching, and combat operations. He has also made modifications to his clothing and equipment to accommodate the SCS programmer so he can change modes as needed. This Soldier represents the optimal outcome for our wounded Warriors with chronic pain from polytrauma.

Unfortunately, the Soldier discussed above does not represent a typical outcome. Currently, the WTB has over 400 Soldiers, 25% of whom are seen in the pain medicine clinic. This proportion is consistent with reported VA statistics that 47% of Veterans reported at least mild pain, and 28% reported pain severe enough to be associated with functional interference.<sup>7</sup> Many of these patients have conditions that are only well treated acutely with opioids. However, since there is no evidence that long-term opioid therapy is an effective pain treatment strategy, every effort is made to develop a plan to limit the use of opioids in the patient's future treatment. Common interventional techniques, such as epidural steroid injections and radiofrequency nerve ablations, as well as tricyclic antidepressants and anticonvulsants have been used as part of a comprehensive treatment plan in many

patients. Effective, early nonopioid pain treatment is absolutely critical to avoid the development of harmful affective-motivational and cognitive-evaluative dimensions of pain, eg, depression and catastrophizing ideations.

The predominate reason to limit chronic opioid use is a basic risk/benefit analysis. Opioids have not been shown to provide clinically significant long-term (more than 3 months) pain relief in the published literature. Anecdotally, once patients pass through the acute pain stage of tissue damage (ie, muscle, bone, tendon/ligament) weaning from opioids may not result in an increase in pain. There is a marked increase in affective symptoms (anxiety, stress, catastrophizing) when opioid withdrawal is contemplated. Many Soldiers have experienced terrible pain. Some have PTSD and/or TBI associated with their pain symptoms. No Soldier ever wishes to experience that level of pain again. Opioids are commonly the medication that initially alleviated the pain and the Soldier believes that they are the reason the pain has not returned. A great deal of trust is required for Soldiers to agree to wean from the medication that they believe is the reason that they are no longer in excruciating pain.

The risks of long-term (more than 2 years) opioid therapy are much clearer. The risk of physical dependence is 100%. Chronic constipation is common, as is sedation, nausea, pruritis, and urinary retention, but these tend to wane with time. The 2 most concerning complications of opioid therapy in Soldiers are abuse/addiction and hypogonadotropic-hypogonadism.

The risk of abuse/addiction is reported from 10% to 18.9% in the literature.<sup>25,26</sup> The rate in our Soldiers is likely near the upper end of the range given that males and younger adults are more likely to develop opioid abuse/dependence.<sup>27</sup>

Long-term (more than 2 years) opioid therapy is clearly associated with hypogonadotropic-hypogonadism. This results in depression of anabolic hormones to include growth hormone, testosterone, and dihydroepiandrosterone. In unpublished data, 12 Soldiers had free and total testosterone levels drawn. All 12 Soldiers were on over 30 mg of morphine or equivalent per day and were found to have low free testosterone levels. This finding is consistent with the

reported literature.<sup>28</sup> Hypogonadism results in depression, lethargy, irritability, impaired wound healing, immunosuppression, osteoporosis, decreased libido, and impotence. All of these symptoms are concerning, especially in young Soldiers with concomitant PTSD or TBI. Opioid therapy and, more directly, side-effects of opioid therapy exacerbate PTSD and TBI. We strongly recommend screening all patients with any of these symptoms who are on opioid therapy for evidence of hypogonadism.

The appropriate use of opioids for patients with chronic pain is an enormously difficult, complex clinical decision. On one hand, you have a Soldier who has been through a traumatic experience and has clear reasons to potentially still have pain responsive to opioids and a psychological affinity for the medication. On the other hand, you have a medication that will clearly be harmful to many patients over the long-term.

Our policy is to have all patients sign an opioid consent statement and opioid conduct agreement prior to the initiation of opioid therapy. The consent statement informs the patient of the known risks of the medication. The conduct agreement defines the "ground rules" for continued opioid management. Soldiers are required to bring their medication bottles to every appointment for random pill counts. They are also subject to random urine toxicology screening. All Soldiers are counseled that periodic "opioid holidays" may be required to determine if opioids are still effective pain therapy. If the Soldier does not experience an increase in pain off opioids, they are not reinitiated.

It is clearly evident that pain treatment is a complex, resource-intensive endeavor without clear empiric evidence to serve as a guide. A key first step in treatment is identifying individuals who are experiencing pain or who are at risk of developing a pain condition. All WTB patients referred to the pain medicine clinic will complete screening tools consistent with the recommendations of the IMMPACT consensus conference.<sup>29</sup> Four chronic pain domains will be evaluated:

- Pain intensity—McGill pain questionnaire
- Physical functioning—brief pain inventory and Epworth sleepiness scales

## Offering Hope for our Wounded Warriors: An Overview of the Womack Army Medical Center Pain Medicine Clinic

- Emotional functioning—Beck depression inventory
- Patient's rating of overall improvement—patient global impression of change scale

These evaluations will be completed on the initial encounter and then every 6 months subsequently. This data will be used to tailor the patient's treatment and ensure that they receive the level of care required. Multidisciplinary care will be provided at WAMC on an outpatient basis. Select patients who require inpatient comprehensive pain rehabilitation are referred as appropriate. A central focus is pain control with selective use of opioids as modeled after the procedures used at the James A. Haley Veterans' Hospital in Tampa, Florida.

Since resources are limited, we have outlined 3 key components that will most effectively leverage our current capital. First, we will improve primary care provider knowledge through our lecture series in an effort to push effective pain techniques to the front lines. Second, in cooperation with Walter Reed Army Medical Center and Johns Hopkins University School of Medicine, we have initiated cutting edge research protocols that have the potential to redefine how some pain conditions are treated. Finally, every effort is made to provide excellent, nonopioid analgesia with peripheral nerve catheters for all Soldiers who are amenable to the technique. Peripheral nerve catheters have proven to be an excellent method of analgesia with the enormous benefit of avoidance of opioid tolerance, dependence, and side effects. These are resource intensive efforts, currently in their infancy at WAMC, which have the potential to mitigate long-term disability due to chronic pain. The results will be decreased health care utilization, decreased health care cost, and, most importantly, improved patient quality of life and function.

Over the next several years, the Army Medical Department will be experiencing the daunting challenge of taking care of our wounded warriors. Early and effective pain treatment is of paramount importance. Early intervention will decrease the long-term risk of disability in this patient population and will also allow our Soldiers to return quickly to the fight. It is essential that a multidisciplinary approach is used that takes into account the physical and mental aspects of each Soldier's care. Our Soldiers are giving

their best to protect and defend this great nation of ours. We owe them our best.

### REFERENCES

1. Pare A, Johnson T. *The apologie and treatise of Ambroise Pare containing the voyages made into divers places with many of his writings upon surgery*. London: Cotes and Young; 1634.
2. Mitchell S. On the diseases of nerves, resulting from injuries. In: Flint A, ed. *Contributions Relating to the Causation and Prevention of Disease, and to Camp Disease*. New York: US Sanitary Commission Memoirs; 1867.
3. White R, Cohen S. Diagnosis, treatment, and return-to-duty rates in soldiers treated in a forward deployed pain management center. *Anesthesiology*. 2007;107:1003-1008.
4. Hoeffler D, Melton L. Changes in the distribution of Navy and Marine Corp Casualties from World War I through the Vietnam conflict. *Mil Med*. 1981;146:776-779.
5. Writer J, DeFraites R, Keep L. Non-battle injury casualties during the Persian Gulf War and other deployments. *Am J Prev Med*. 2000;18:64-70.
6. Cohen S, Griffith S, Villena F. Presentation, diagnoses, mechanisms of injury, and treatment in soldiers injured in Operation Iraqi Freedom: an epidemiological study conducted at two military pain management centers. *Anesth Analg*. 2005;101:1098-1103.
7. Gironda R, Clark M, Massengale A, Walker R. Pain among veterans of Operation Enduring Freedom and Iraqi Freedom. *Pain Med*. 2006;7:339-343.
8. Gureje O. Persistent pain and well-being: a World Health Organization study in primary care. *JAMA*. 1998;280:147-151.
9. Melzack R, Wall P. Pain mechanisms: a new theory. *Science*. 1965;150:971-979.
10. De Leo J. Basic science of pain. *J Bone Joint Surg Am*. 2006;88(suppl 2):58-62.
11. Melzack R, Katz J. The gate control theory: reaching for the brain. In: Hadjistavropoulos T, Craig KD, eds. *Pain: Psychological Perspectives*. New York: Lawrence Erlbaum; 2004:13-34.
12. Bryant R, Marosszeky J, Crooks J, Baguley I, Gurka J. Interaction of posttraumatic stress disorder and chronic pain following traumatic brain injury. *J Head Trauma Rehabil*. 1999;14:588-594.

13. Drottning M, Staff P, Levin L. Acute emotional responses to common whiplash predicts subsequent pain complaints. A prospective study of 107 subjects sustaining whiplash injury. *Nordic J Psychiatry*. 1995;49:293-299.
14. Smith T, Aberger E, Follick M. Cognitive distortion and disability in chronic low back pain. *J Consult Clin Psychol*. 1986;54:573-575.
15. Difede J, Jaffe A, Musngi G. Determinants of pain expression in hospitalized burn patients. *Pain*. 1997;72:245-251.
16. Bryant R, Harvey A. Processing threatening information in post-traumatic stress disorder. *J Abnorm Psychol*. 1995;104:537-541.
17. Chou R, Huffman L. Nonpharmacologic therapies for acute and chronic low back pain: A review of the evidence for an American pain society/American College of Physicians clinical practice guideline. *Ann Intern Med*. 2007;147:492-504.
18. Fairbank J, Frost H, Wilson-MacDonald J, Yu L, Barker K, Collins R. Randomised controlled trial to compare surgical stabilisation of the lumbar spine with an intensive rehabilitation programme for patients with chronic low back pain: the MRC spine stabilisation trial. *BMJ*. 2005;330(7502):1233-1238.
19. Brox JI, Sorensen R, Friis A, et al. Randomized clinical trial of lumbar instrumented fusion and cognitive intervention and exercises in patients with chronic low back pain and disc degeneration. *Spine*. 2003;28(17):1913-1921.
20. Turk D. Clinical effectiveness and cost-effectiveness of treatments for patients with chronic pain. *Clin J Pain*. 2002;18:355-365.
21. Kemler MA, de Vet H, Barendse GA, van den Wildenberg F, van Kleef M. Spinal cord stimulation for chronic reflex sympathetic dystrophy-five-year follow-up. *N Engl J Med*. 2006;354:2394-2396.
22. Kemler MA, Barendse GA, van Kleef M, et al. Spinal cord stimulation in patients with chronic reflex sympathetic dystrophy. *N Engl J Med*. 2000;343:618-624.
23. Grabow TS, Tella PK, Srinivasa N, Raja M. Spinal cord stimulation for complex regional pain syndrome: an evidence-based medicine review of the literature. *Clin J Pain*. 2003;19:371-383.
24. Verdolin M, Stedje-Larsen E, Hickey A. Ten consecutive cases of complex regional pain syndrome of less than 12 months duration in active duty United States Military Personnel treated with spinal cord stimulation. *Anesth Analg*. 2007;104:1557-1560.
25. Fishbain D, Rosomoff H, Rosomoff R. Drug abuse, dependence, and addiction in chronic pain patients. *Clin J Pain*. 1992; 8:77-85.
26. Portenoy R, Foley K. Chronic use of opioid analgesics in non-malignant pain: report of 38 cases. *Pain*. 1986;25:171-86.
27. Edlund M, Steffick D, Hudson T, Harris K, Sullivan M. Risk factors for clinically recognized opioid abuse and dependence among veterans using opioids for chronic non-cancer pain. *Pain*. 2007;129:355-362.
28. Daniell H. Hypogonadism in men consuming sustained-action oral opioids. *J Pain*. 2002;3:377-384.
29. Dworkin R, Turk D, Wyrwich K, Beaton D. Interpreting the clinical importance of treatment outcomes in chronic pain clinical trials: IMMPACT recommendations. *J Pain*. In press.

## AUTHORS

MAJ Weber is Chief, Anesthesiology Service, Department of Surgery, Womack Army Medical Center, Fort Bragg, North Carolina.

MAJ Dragovich is Medical Director of the Pain Medicine Clinic, Department of Surgery, Womack Army Medical Center, Fort Bragg, North Carolina.



# ***The “Silent Killer”: Hyperventilation in the Brain Injured***

LTC(P) Lorne H. Blackbourne, MC, USA

MAJ John Cole, MC, USA

MAJ Robert Mabry, MC, USA

MAJ Andrew Morgan, MC, USA

LTC Paul Barras, AN, USA

COL Brian Eastridge, MC, USA

COL John B. Holcomb, MC, USA

## **INTRODUCTION**

The ability of modern medicine to effect a “cure” for severely brain-injured patients is limited. The initial impact or insult represents the primary injury and intervention for this injury is purely preventive. Secondary injury represents the deleterious cascade of events which occur after the initial insult, some portions of which can be mitigated by intervention. The most important goal of treating brain-injured patients is avoidance of secondary injury. Multiple strategies to minimize secondary insult include maintaining oxygenation, and maintaining a normal blood pressure and attendant cerebral perfusion pressure. Maintenance of blood flow and associated delivery of oxygen and nutrients helps keep tissue viable and is one way to avoid secondary injury.<sup>1</sup> Prehospital hypotension (systolic blood pressure less than 90 mm Hg) and low oxyhemoglobin saturation (below 90%) have been documented as risk factors for death and poor outcome in brain-injured patients transported to civilian trauma centers.<sup>2,3</sup> The avoidance of hypotension in the brain-injured is of particular significance to military medics as the use of “hypotensive resuscitation” in penetrating injury must be abandoned in the brain-injured patient. The skull is typically a fixed volume structure. Increased intracranial pressure (ICP) results in decreased cerebral blood flow and may result in brain tissue ischemia and necrosis. One method to rapidly decrease ICP commonly employed in the past was hyperventilation. Hyperventilation has been found to be detrimental to the brain-injured patient in all but the most dire situations (eg, brain herniation).<sup>4</sup> It is now established that cerebral vasoconstriction due to profound hypocarbica (low carbon dioxide blood levels) from hyperventilation results in deleterious brain tissue

hypoxia and may increase mediators of secondary brain injury.<sup>5-7</sup>

Hyperventilation and extreme hypocarbica are especially worrisome as most medics and many transfer personnel do not have a means to monitor carbon dioxide levels, making hyperventilation in the brain-injured potentially a “silent iatrogenic killer.”

## **OXYGENATION**

Oxygenation is the delivery of oxygen to the lungs and is not effected by ventilation except at very low rates of gas exchange. Oxygenation is related to the amount of oxygen delivered in the inspired gas to the alveoli. Atmospheric air is 21% oxygen. The brain-injured patient often requires an increase in the inspired oxygen content ( $\text{FiO}_2$ ) to have adequate saturation of the arterial hemoglobin ( $\text{SaO}_2$ ). An increase in oxygen concentration can be obtained with bottled oxygen, a fire hazard as oxygen is a fire accelerant. The other option for increasing the  $\text{FiO}_2$  is an oxygen concentrator to concentrate the oxygen in inspired gas. Adequate oxygenation is important in avoiding ischemia (lack of adequate oxygen) of the injured brain.

While the majority of combat wounded will not benefit from supplemental oxygenation, the subset of the severely head injured may benefit from it.<sup>5-8</sup>

## **HYPERVENTILATION AND HYPOVENTILATION**

Ventilation is the process by which gases are moved into and out of the lungs which, among other things, results in carbon dioxide ( $\text{CO}_2$ ) gas exchange. Ventilation is separate from oxygenation. The amount

of gas passed through the lungs by bag valve mask or a ventilator results in a loss of CO<sub>2</sub> directly correlated with the rate of ventilation. The amount of CO<sub>2</sub> is then reflected in the amount of CO<sub>2</sub> present in the arterial blood, known as PaCO<sub>2</sub> (normal PaCO<sub>2</sub> is 35 to 45 mm Hg). If ventilation is increased, the PaCO<sub>2</sub> will fall. If ventilation is slowed, the PaCO<sub>2</sub> will rise. A low PaCO<sub>2</sub> is termed hypocarbia, and an elevated PaCO<sub>2</sub> is termed hypercarbia.

## CO<sub>2</sub> AND THE BRAIN

The cerebral arteries are very sensitive to levels of CO<sub>2</sub> in the blood stream. The response of cerebral arteries to increasing levels of PaCO<sub>2</sub> in the blood is vasodilation. This results in a larger cerebral blood volume and (due to the fixed space of the skull) results in an increase in ICP (known as the Monroe-Kellie hypothesis). The response to lower levels of PaCO<sub>2</sub> is opposite. A reduction in PaCO<sub>2</sub> causes cerebral arterial vasoconstriction resulting in lower brain blood volume and lower intracranial pressure. However this occurs at the theoretical expense of blood flow (with oxygen and nutrients) to the areas of injured brain. The response of cerebral arteries to different levels of CO<sub>2</sub> in the bloodstream may even be exaggerated in ischemic, injured cerebral vessels.<sup>9-12</sup> The early post-injury period is especially significant as cerebral blood flow during the first day after injury is markedly reduced and is often less than half that of normal individuals.<sup>13,14</sup> This results in a potentially increased susceptibility to secondary insult.

## METHODS FOR MONITORING BLOOD CO<sub>2</sub> LEVELS

There are no clinical signs to help determine blood levels of CO<sub>2</sub>. The "gold standard" for PaCO<sub>2</sub> is an arterial blood gas evaluation.<sup>15</sup> The next best method is a venous blood gas. Although this method is less accurate, it will help in ruling out the extremes of PaCO<sub>2</sub> levels.<sup>16</sup> The best noninvasive method to determine the PaCO<sub>2</sub> is end-tidal PaCO<sub>2</sub>, also known as capnometry. End-tidal PaCO<sub>2</sub> monitors measure the CO<sub>2</sub> level of exhaled gases and usually give a value slightly lower value than the arterial PaCO<sub>2</sub> due to mixing with dead space air.<sup>17</sup> End-tidal PaCO<sub>2</sub> monitoring is most accurate in intubated and ventilated patients. However, the utility of this monitoring modality is limited to the avoidance of extremely low or high PaCO<sub>2</sub> levels.<sup>18,19</sup> Specifically, end-tidal CO<sub>2</sub> determinations have been documented to be of benefit in avoiding hyperventilation in ventilated head injured

patients.<sup>15,20</sup> Additionally, patients have also been successfully monitored with end-tidal PaCO<sub>2</sub> monitors in the nonintubated state.<sup>21</sup> End-tidal CO<sub>2</sub> monitors have the added benefit of helping to determine if inadvertent esophageal intubation has occurred.<sup>22-24</sup>

## BRAIN HERNIATION

The only clinical indication for iatrogenic hyperventilation with the goal of hypocarbia is cerebral herniation. Herniation occurs when the brain is forced out of the skull through the foramen magnum or assumes an abnormal intracranial position secondary to severe elevation in intracranial pressure (eg, transtentorial uncal herniation). The signs of brain herniation include flexor or extensor posturing and/or asymmetric or nonreactive (blown) pupil. The Brain Injury Foundation guidelines recommend doubling the prehospital normal ventilation rate (20 breaths/minute in adults) in patients with clinical signs of brain herniation to achieve iatrogenic hyperventilation and attendant hypocarbia.<sup>25</sup>

## CIVILIAN PARAMEDIC AND TRANSPORT OF BRAIN-INJURED DATA

Prehospital hypotension and hypoxia in the brain-injured patients are established risk factors for increased mortality and poor outcomes. Additionally, hyperventilation and hypocarbia are recognized as a preventable cause of iatrogenic secondary brain injury. The use of orotracheal intubation without end-tidal PaCO<sub>2</sub> monitoring prehospital by US civilian paramedics has been associated with an increase in mortality and deleterious effect on survivors.<sup>26,27</sup> This increase in mortality and poor neurologic outcomes of intubated and ventilated brain-injured patients is thought to be due to hypocarbia from hyperventilation.<sup>27-29</sup> The optimal PaCO<sub>2</sub> during transport has not been clearly defined although admission PaCO<sub>2</sub> levels from 30 to 39 mm Hg have been associated with lower mortality and better survival outcomes.<sup>30,31</sup> The use of end-tidal capnometry has been demonstrated to be effective in avoiding prehospital hyperventilation and hypocarbia in intubated head-injured patients.<sup>15,21,32-34</sup> Replacing the bag valve mask in the intubated patient with a mobile ventilator removes the human error and has been demonstrated to produce more uniform PaCO<sub>2</sub> levels and better outcomes.<sup>35</sup> Hyperventilation is often the result of low saturations en route to the hospital where the paramedic treats hypoxia with the natural response of more vigorous ventilation.<sup>36</sup>

## The "Silent Killer": Hyperventilation in the Brain Injured

### OPTIMAL HAND-BAG VENTILATION OF BRAIN-INJURED PATIENTS

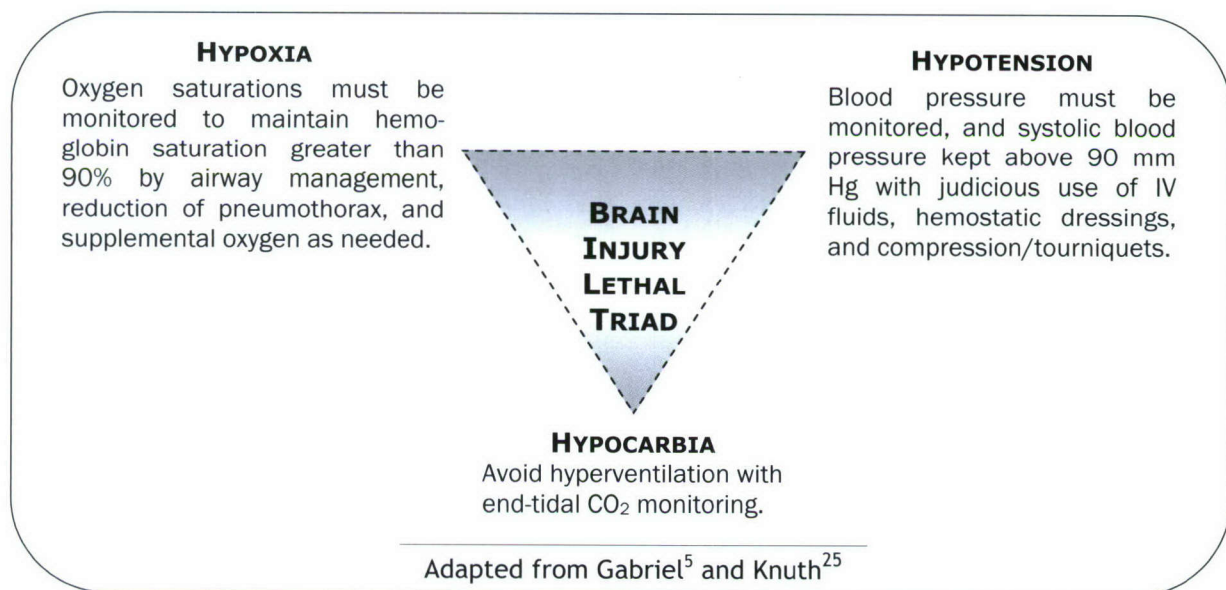
Currently, hand-bagging ventilation is an imprecise art allowing for a wide range of minute ventilations and resultant PaCO<sub>2</sub> levels. The natural response in ventilating severely injured patients is aggressive over-ventilation. Hand strength, single hand-bagging, 2-handed hand-bagging, and frequency of bag compressions are all factors in the use of the bag valve mask.<sup>37</sup> In one study, squeezing a standard one-liter bag with a single hand gives a different mean amount of gas ventilation (694 cm<sup>3</sup> per compression) when compared to a mean 2-hand squeeze of the same one-liter bag (827 cm<sup>3</sup> per compression).<sup>38</sup> The standard minute ventilation (the amount of gas ventilated per minute) for a normal PaCO<sub>2</sub> in a 70 kg patient is approximately 10 times the body weight in kilograms. Thus a 70 kg patient will have a minute ventilation of approximately 700 cm<sup>3</sup>, and the Brain Injury Foundation recommends 10 breaths per minute ventilation in brain-injured patients prehospital.<sup>5</sup> With a goal of 10 cm<sup>3</sup>/kg as a guide, the optimal gas exchange will use a different frequency of bag compressions, depending on whether the patient is single hand-bagged (approximately 10 compressions per minute if 70 kg) or hand-bagged by 2 hands (approximately 8 compressions per minute if 70 kg). This variability can prove detrimental if it results in iatrogenic hypocarbia.

### MAXIMIZING EN ROUTE CARE OF COMBAT BRAIN-INJURED PATIENTS

The application of patient management strategies derived from civilian studies to the battlefield is limited because of significant differences between the patient populations. There are substantive differences between the populations in terms of injury pattern and ballistics. However, until combat data contrary to the civilian data are established, the practice of transporting combat injured patients should mirror the goals of civilian paramedics.

All efforts should be made to avoid the triad of secondary brain injury (illustrated below).

While hypotension and hypoxia are routinely considered, hypocarbia is often overlooked by combat medics and transport personnel. All combat brain-injured patients intubated and ventilated should have an end-tidal CO<sub>2</sub> monitor and every effort should be made to provide mobile mechanical ventilators for ventilation (to remove the imprecise hand-bagging ventilation). All personnel involved with the bag valve mask should be trained in the correct hand-bagging frequency, tidal volume, and technique. Optimally, the brain-injured should be ventilated with an additional oxygen supply—in the safest way, possibly with a small oxygen concentrator to avoid the hazards of bottled oxygen—to avoid the deleterious effects of hypoxia and the resultant increase in the frequency of



hand-bagging often triggered by the hypoxia that causes or exacerbates hyperventilation. In this manner, the detrimental effects of hyperventilation and its resultant hypocarbia can be avoided.

## FUTURE

The optimal care of brain injured may include ventilation and oxygenation based upon minute-to-minute computerized "feedback loop" analysis.<sup>39</sup> A computerized feedback loop on a ventilator would implement changes in delivered oxygen levels based on the hemoglobin saturations. Additionally, the ventilator rate and tidal volumes of positive pressure ventilation would continuously adjust in response to measurements of the end-tidal CO<sub>2</sub> levels. Bag valve mask ventilation could be improved in the near future with a precise mechanism for measuring delivered tidal volumes, and with an attached end-tidal CO<sub>2</sub> monitor. The development of an accurate noninvasive

monitor of arterial PaCO<sub>2</sub> would be optimal for combat brain injured as well as a huge medical advancement.

## CONCLUSIONS

"First do no harm." Prevention of iatrogenic secondary brain injury in the combat environment is limited. However, relatively simple protocol changes and acquisition of simple and inexpensive technology can potentially result in meaningful differences in outcome. The ventilation status of combat brain injured should be revisited by all care providers to avoid inadvertent hyperventilation. End-tidal CO<sub>2</sub> monitors should be placed on all casualty evacuation and medical evacuation platforms, and level I and level II military medical facilities, and used for all intubated head-injured patients to avoid extreme PaCO<sub>2</sub> levels in this patient population.

## REFERENCES

1. Elf K, Nilsson P, Enblad P. Prevention of secondary insults in neurointensive care of traumatic brain injury. *Eur J Trauma*. 2003;29:74-80.
2. Chesnut RM, Marshall LF, Klauber MR, et al. The role of secondary brain injury in determining outcome from severe head injury. *J Trauma*. 1993;34:216-222.
3. Fearnside MR, Cook RJ, McDougall P, et al. The West-mead Head Injury Project outcome in severe head injury. A comparative analysis of pre-hospital, clinical, and CT variables. *Br J Neurosurg*. 1993;7:267-279.
4. Muizelaar JP, Marmarou A, Ward JD, et al. Adverse effects of prolonged hyperventilation in patients with severe head injury: a randomized clinical trial. *J Neurosurg*. 1991;75:731-739.
5. Gabriel E, Ghajar G, Jogada A, et al. *Guidelines for Prehospital Management of Traumatic Brain Injury*. New York: Brain Injury Foundation; 2000. Available at: <http://www.braintrauma.org>.
6. Marion DW, Puccio A, Wisniewski SR, et al. Effect of hyperventilation on extracellular concentrations of glutamate, lactate, pyruvate, and local cerebral blood flow in patients with severe traumatic brain injury. *Crit Care Med*. 2002;30(12):2619-2625.
7. Coles JP, Minhas PS, Fryer TD, et al. Effect of hyperventilation on cerebral blood flow in traumatic head injury: clinical relevance and monitoring correlates. *Crit Care Med*. 2002;30(9):1950-1959.
8. Stockinger ZT, Mcswain NE Jr. Prehospital supplemental oxygen in trauma patients: its efficacy and implications for military medical care. *Mil Med*. 2004;169(8):609-612.
9. McLaughlin MR, Marion DW. Cerebral blood flow and vasoresponsivity within and around cerebral contusions. *J Neurosurg*. 1996;85:871-876.
10. Marion DW, Darby J, Yonas H. Acute regional cerebral blood flow changes caused by severe head injuries. *J Neurosurg*. 1991;74:407-414.
11. Salvant JB, Jr., Muizelaar JP. Changes in cerebral blood flow and metabolism related to the presence of subdural hematoma. *Neurosurgery*. 1993;33:387-393.
12. Raichle ME, Plum F. Hyperventilation and cerebral blood flow. *Stroke*. 1972;3:566-575.
13. Bouma GJ, Muizelaar JP, Stringer WA, et al. Ultra-early evaluation of regional cerebral blood flow in severely head-injured patients using xenon-enhanced computerized tomography. *J Neurosurg*. 1992;77:360-368.
14. Fieschi C, Battistini N, Beduschi A, et al. Regional cerebral blood flow and intraventricular pressure in acute head injuries. *J Neurol Neurosurg Psychiatry*. 1974;37:1378.
15. Davis DP, Dunford JV, Ochs M, Park K, Hoyt DB. The use of quantitative end-tidal capnometry to avoid inadvertent severe hyperventilation in patients with head injury after paramedic rapid sequence intubation. *J Trauma*. 2004;56(4):808-814.

## The "Silent Killer": Hyperventilation in the Brain Injured

16. Chu YC, Chen CZ, Lee CH, Chen CW, Chang HY, Hsiue TR. Prediction of arterial blood gas values from venous blood gas values in patients with acute respiratory failure receiving mechanical ventilation. *J Formos Med Assoc.* 2003;102(8):539-543.
17. Russell GB, Graybeal JM. End-tidal carbon dioxide as an indicator of arterial carbon dioxide in neurointensive care patients. *J Neurosurg Anesthesiol.* 1992;4(4):245-249.
18. Hoffman RA, Krieger BP, Kramer MR, et al. End-tidal carbon dioxide in critically ill patients during changes in mechanical ventilation. *Am Rev Respir Dis.* 1989;140(5):1265-1268.
19. Ferber J, Juniewicz HM, Lechowicz-Głogowska EB, Pieniek R, Wroński J. Arterial to end-tidal carbon dioxide difference during craniotomy in severely head-injured patients. *Folia Med Cracov.* 2001;42(4):141-152.
20. Helm M, Schuster R, Hauke J, Lampl L. Tight control of prehospital ventilation by capnography in major trauma victims. *Br J Anaesth.* 2003;90:327-332.
21. Kober A, Schubert B, Bertalanffy P. Capnography in nontracheally intubated emergency patients as an additional tool in pulse oximetry for prehospital monitoring of respiration. *Anesth Analg.* 2004;98(1):206-210.
22. Grmec S, Mally S. Prehospital determination of tracheal tube placement in severe head injury. *Emerg Med J.* 2004;21:518-520.
23. Takeda T, Tanigawa K, Tanaka H, Hayashi Y, Goto E, Tanaka K. The assessment of three methods to verify tracheal tube placement in the emergency setting. *Resuscitation.* 2003;56(2):153-157.
24. Timmermann A, Russo SG, Eich C, et al. The out-of-hospital esophageal and endobronchial intubations performed by emergency physicians. *Anesth Analg.* 2007;104(3):619-623.
25. Knuth T, Letarte P, Ling G, et al. *Guidelines for Field Management of Combat-Related Head Trauma.* New York: Brain Injury Foundation; 2005. Available at: <http://www.braintrauma.org>.
26. Davis DP, Hoyt DB, Ochs M, et al. The effect of paramedic rapid sequence intubation on outcome in patients with severe traumatic brain injury. *J Trauma.* 2003;54(3):444-453.
27. Davis DP, Peay J, Sise MJ, et al. The impact of prehospital endotracheal intubation on outcome in moderate to severe traumatic brain injury. *J Trauma.* 2005;58(5):933-939.
28. Davis DP, Dunford JV, Poste JC, et al. The impact of hypoxia and hyperventilation on outcome after paramedic rapid sequence intubation of severely head-injured patients. *J Trauma.* 2004;57(1):1-8.
29. Lal D, Weiland S, Newton M, Flaten A, Schurr M. Prehospital hyperventilation after brain injury: a prospective analysis of prehospital and early hospital hyperventilation of the brain-injured patient. *Prehospital Disaster Med.* 2003;18(1):20-23.
30. Davis DP, Stern J, Sise MJ, Hoyt DB. A follow-up analysis of factors associated with head-injury mortality after paramedic rapid sequence intubation. *J Trauma.* 2005;59(2):486-490.
31. Warner K, Cushieri J, Copass M, Jurkovich G, Bulger E. Emergency department ventilation effects outcome in severe brain injury. Western Trauma Association Abstract, 2007. Contact: <http://www.westerntraumaassociation.org/index.html>.
32. Davis DP, Idris AH, Sise MJ, et al. Early ventilation and outcome in patients with moderate to severe traumatic brain injury. *Crit Care Med.* 2006;34(4):1202-1208.
33. Poste JC, Davis DP, Ochs M, et al. Air medical transport of severely head-injured patients undergoing paramedic rapid sequence intubation. *Air Med J.* 2004;23(4):36-40.
34. Bernard SA. Paramedic intubation of patients with severe head injury: a review of current Australian practice and recommendations for change. *Emerg Med Australas.* 2006;18(3):221-228.
35. Davey AL, Macnab AJ, Green G. Changes in PaCO<sub>2</sub> during air medical transport of children with closed head injuries. *Air Med J.* 2001;20(4):27-30.
36. Davis DP, Douglas DJ, Koenig W, Carrison D, Buono C, Dunford JV. Hyperventilation following aero-medical rapid sequence intubation may be a deliberate response to hypoxemia. *Resuscitation.* 2007;73(3):354-361.
37. Hess D, Spahr C. An evaluation of volumes delivered by selected adult disposable resuscitators: the effects of hand size, number of hands used, and use of disposable medical gloves. *Respir Care.* 1990;35(8):800-805.
38. McCabe SM, Smeltzer SC. Comparison of tidal volumes obtained by one-handed and two-handed ventilation techniques. *Am J Crit Care.* 1993;2(6):467-473.
39. Hoskins SL, Elgjo GI, Lu J, et al. Closed-loop resuscitation of burn shock. *J Burn Care Res.* 2006;27(3):377-385.

## THE ARMY MEDICAL DEPARTMENT JOURNAL

### AUTHORS

LTC(P) Blackbourne is Chief, Trauma Service, Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

MAJ Cole is a staff neurosurgeon, Brooke Army Medical Center, Fort Sam Houston, Texas.

MAJ Mabry is the Emergency Medicine Fellow, US Army Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

MAJ Morgan is the Battalion Surgeon, 3rd Special Forces Group, Womack Army Medical Center, Fort Bragg, North Carolina.

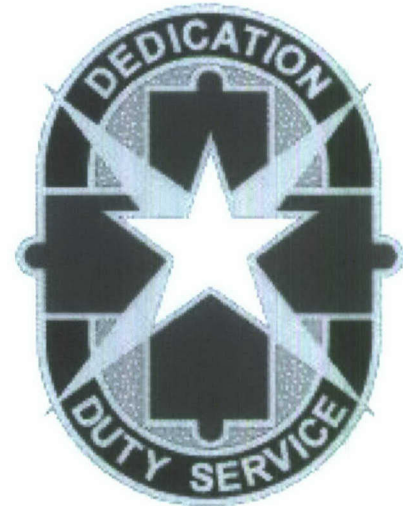
LTC Barras is the Assistant Chief Nurse Anesthetist, Womack Army Medical Center, Fort Bragg, North Carolina.

COL Eastridge is the Program Director, Surgical Critical Care, US Army Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

COL Holcomb is Commander, US Army Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas, and Trauma Consultant to The Army Surgeon General.



**Womack Army  
Medical Center**



**Brooke Army  
Medical Center**



# Joseph Lister, Noncompressible Arterial Hemorrhage, and the Next Generation of “Tourniquets”?

LTC(P) Lorne H. Blackbourne, MC, USA  
MAJ Robert Mabry, MC, USA  
LTC James Sebesta, MC, USA  
COL John B. Holcomb, MC, USA

Hemorrhage remains the greatest threat to life on the battlefield, accounting for half of all deaths.<sup>1</sup> In recent military conflicts, newly designed and tested tourniquets and more aggressive tourniquet use guidelines, hemostatic dressings, fluids for resuscitation, and innovative methods of resuscitation are the current options available to military medics. None of these treatments, however, are able to stop bleeding from “noncompressible injuries.” Current tourniquets can stop arterial hemorrhage distal to the groin crease and axilla where the tourniquet can be placed circumferentially. During evacuation and before reaching definitive care, manual pressure and hypotensive resuscitation, in which the patient’s blood pressure is kept at approximately 90 mm Hg, is about the only method at our disposal for handling noncompressible arterial hemorrhage in the groin and axilla.<sup>2</sup> An intriguing device created by Joseph Lister in 1862 may be the starting point for an addition to the medic’s armamentarium in the field to extend the anatomic geography for mechanical hemostasis by compressing the groin and axillary vessels.

Joseph Lister is best known for his introduction and vigorous promotion of antiseptic surgical technique and wound care, but he also made a number of significant contributions to surgical technology<sup>3</sup>:

Abdominal tourniquet	Chromic catgut suture
Cork aortic compressor	Sinus forceps
Hernia bistouries	Patella hook
Urethral forceps	Suprapubic retractor
Tracheal retractor	Wire hammer
Fracture steel pegs	Bone forceps

Of interest to us here is a curious invention that he called the “abdominal tourniquet,” shown in Figure 1.

Because extremity tourniquets could not stop proximal arterial blood flow during hip surgery, Lister designed a mechanical means of stopping the inflow of blood to the hip. He commissioned W. B. Hilliard of Glasgow to construct this “abdominal tourniquet,” based on the common C-clamp, to his specifications for placement externally above the aorta, compressing the aorta to stop the flow of blood distally, as shown in his illustration demonstrating its use (Figure 2).

It is unlikely, however, that Lister’s abdominal tourniquet ever saw much action. Although no physical evidence of the tool survived, a similar device was designed and manufactured by Joseph Pancoast of Philadelphia at about the same time that Lister’s was produced. Pancoast reported several proximal thigh and hip surgeries with very limited blood loss and no interruption of respiration while the patient received ether breathing spontaneously.<sup>4</sup> Several other similar C-clamp extremity tourniquets were also invented around the time of the American Civil War, mainly to avoid circumferential compression and the resultant gangrene. Dupuytren’s compressor and the Signori tourniquets were clamp-like devices, such as that shown in Figure 3, but were difficult to position



Figure 1. Joseph Lister’s Aortic Tourniquet (circa 1862).

Reprinted with permission. Copyright: Hunterian Museum at The Royal College of Surgeons of England.

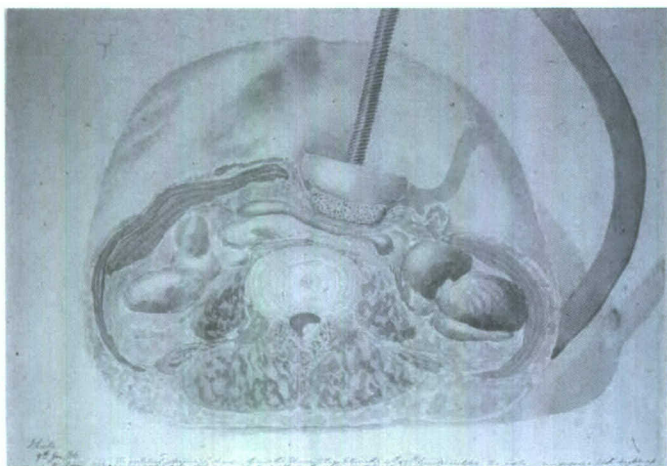


Figure 2. Watercolor painting by Joseph Lister demonstrating the placement of the transabdominal abdominal tourniquet.

Reprinted with permission. Copyright: Hunterian Museum at The Royal College of Surgeons of England.

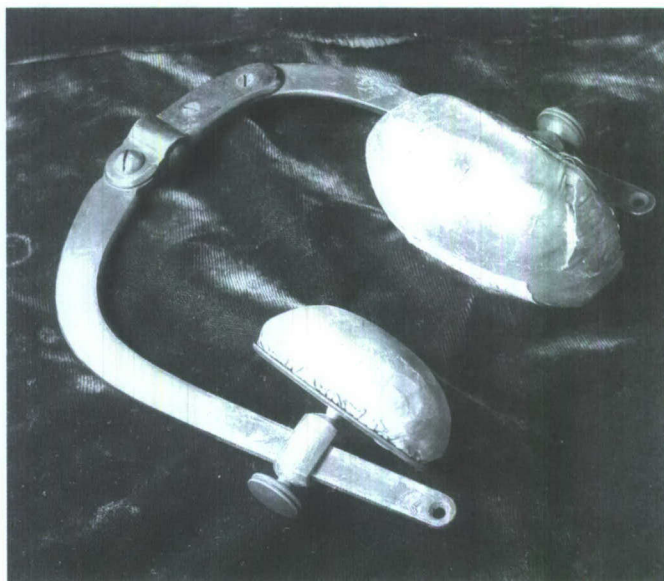


Figure 3. C-clamp extremity tourniquet from the era of the American Civil War

effectively. These devices were eventually abandoned in favor of the Petit tourniquet.<sup>5,6</sup>

#### POTENTIAL ROLE FOR MODIFYING THE ABDOMINAL TOURNIQUET FOR THE BATTLEFIELD

Inability to maintain hemostasis with manual pressure in an exsanguinating groin injury was widely publicized after the death of a US Soldier in Somalia in 1993.<sup>7,8</sup> Considerable time and thought have gone into treating this injury, including several studies exploring hemostatic agents that can be poured, packed, or sprayed directly into the wound.<sup>9-12</sup> Today's engineering capabilities, computer imaging, and high tech materials could possibly make Lister's 19th century idea a reality. A version of Lister's abdominal tourniquet using a modified adjustable bar clamp placed over the groin, axilla, or clavicle (as illustrated in Figures 4, 5, 6, and 7) by medics on the battlefield could possibly impede blood flow through the external iliac, proximal femoral or axillary arteries, which may allow a Soldier with a currently noncompressible wound to reach definitive care alive.

Currently, mechanical hemostasis involving the groin vessels is actually being successfully obtained by a commercially available device for use after femoral artery catheter puncture (Figure 8).

Using space age materials and engineering, such a device could be shaped to conform to the pelvic outlet/axilla and easily folded into a small mobile unit.

#### CONCLUSION

Joseph Lister was a unique individual who often took unique approaches to problems. Now, more than 100 years after the use of his design for cessation of arterial blood flow to the pelvis and groin, the idea may hold answers to battlefield treatment of currently noncompressible bleeding which is not amenable to currently available tourniquet design. But first, we must overcome the initial skepticism historically associated with Joseph Lister's work.



Figure 4. Modified adjustable bar clamp applied to groin blood vessels.

**Joseph Lister, Noncompressible Arterial Hemorrhage, and the Next Generation of "Tourniquets"?**

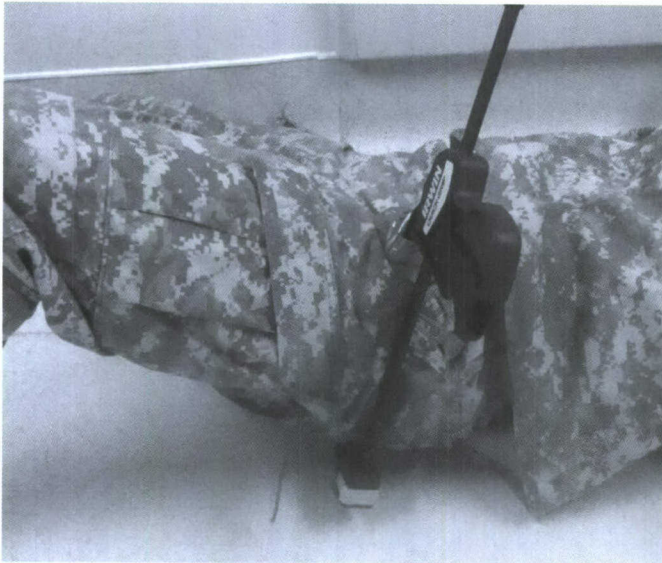


Figure 5. Modified adjustable bar clamp applied to groin blood vessels.



Figure 6. Modified adjustable bar clamp applied to compress infraclavicular axillary blood vessels.

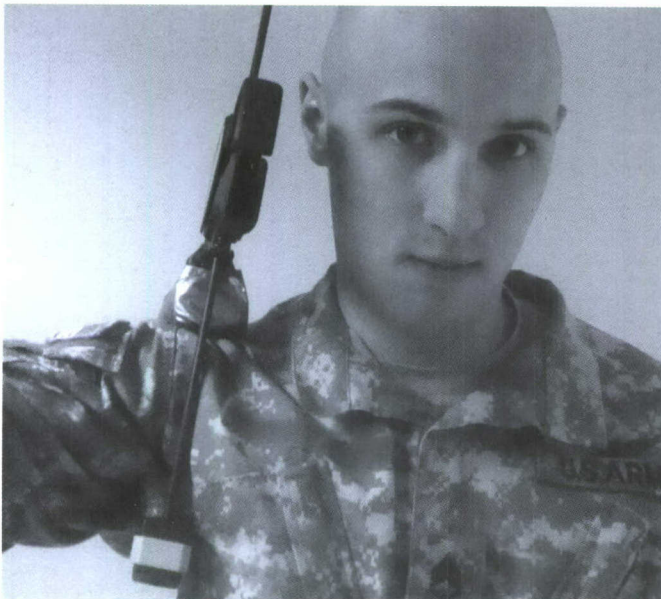


Figure 7. Adjustable bar clamp applied to provide compression of axillary blood vessels.



Figure 8. Commercially available femoral artery puncture site compression device applied to the groin.

## REFERENCES

1. Bellamy RF. The causes of death in conventional land warfare: implications for combat casualty care research. *Mil Med.* 1984;149:55-62.
2. McSwain NE, et al. *PHTLS Prehospital Trauma Life Support: Military Edition*. 5th ed. St Louis, MO: Mosby/Jems/Elsevier; 2003.
3. Wangenstein OH, Wangenstein SD, Klinger CF. Some pre-Listerian and post-Listerian antiseptic wound practices and the emergence of asepsis. *Surg Gynecol Obstet.* 1973;137:677-702.
4. Atkinson WB, Pancoast J. *Physicians and Surgeons of the United States*. Philadelphia, PA: Charles Robson; 1878:710.
5. Helling TS, McNabney K. The role of amputation in the management of battlefield casualties: a history of two millennia. *J Trauma.* 2000;49:930-939.
6. Welling DR, Burris D, Hutton J, Minken S, Rich N. A balanced approach to tourniquet use: lessons learned and relearned. *J Am Col Surg.* 2006;203:106-115.
7. Mabry RL, Holcomb JB, Baker AM, et al. United States Army Rangers in Somalia: an analysis of combat casualties on an urban battlefield. *J Trauma.* 2000;49:515-528.
8. Kurzweg FT. Vascular injuries associated with penetrating wounds of the groin. *J Trauma.* 1980;20:214-219.
9. Pusateri AE, Holcomb JB, Kheirabadi BS, et al. Making sense of the preclinical literature on advanced hemostatic products. *J Trauma.* 2006;60:674-682.
10. Ahuja N, Ostomel TA, Rhee P, et al. Testing of modified zeolite hemostatic dressings in a large animal model of lethal groin injury. *J Trauma.* 2006;61(6):1312-1320.
11. Alam HB, Chen Z, Jaskille A, et al. Application of a zeolite hemostatic agent achieves 100% survival in a lethal model of complex groin injury in swine. *J Trauma.* 2004;56(5):974-983.
12. Alam HB, Uy GB, Miller D, et al. Comparative analysis of hemostatic agents in a swine model of lethal groin injury. *J Trauma.* 2003;54(6):1077-1082.

## AUTHORS

LTC(P) Blackburne is Chief, Trauma Service, at the Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

MAJ Mabry is the Emergency Medicine Fellow, US Army Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

LTC Sebesta is a General Surgeon at the Madigan Army Medical Center, Fort Lewis, Washington.

COL Holcomb is Commander, US Army Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas, and Trauma Consultant to The Army Surgeon General.



# Maximizing Patient Thermoregulation in US Army Forward Surgical Teams

LTC(P) Lorne H. Blackbourne, MC, USA

LTC Kurt W. Grathwohl, MC, USA

LTC Paul Barras, AN, USA

COL Brian Eastridge, MC, USA

## INTRODUCTION

The forward surgical team (FST), designed for mobility, provides level II forward life saving and resuscitative surgery. Resuscitative surgery includes controlling hemorrhage from traumatic amputation, as well as damage control surgery, usually an “abbreviated” laparotomy or thoracotomy. The goals of the abbreviated operation are to stop hemorrhage and gastrointestinal soilage.<sup>1</sup> The overall goal of damage control surgery includes avoidance of acidosis, coagulopathy, and hypothermia, also known as the “lethal triad” or “bloody viscous cycle.”<sup>2</sup>

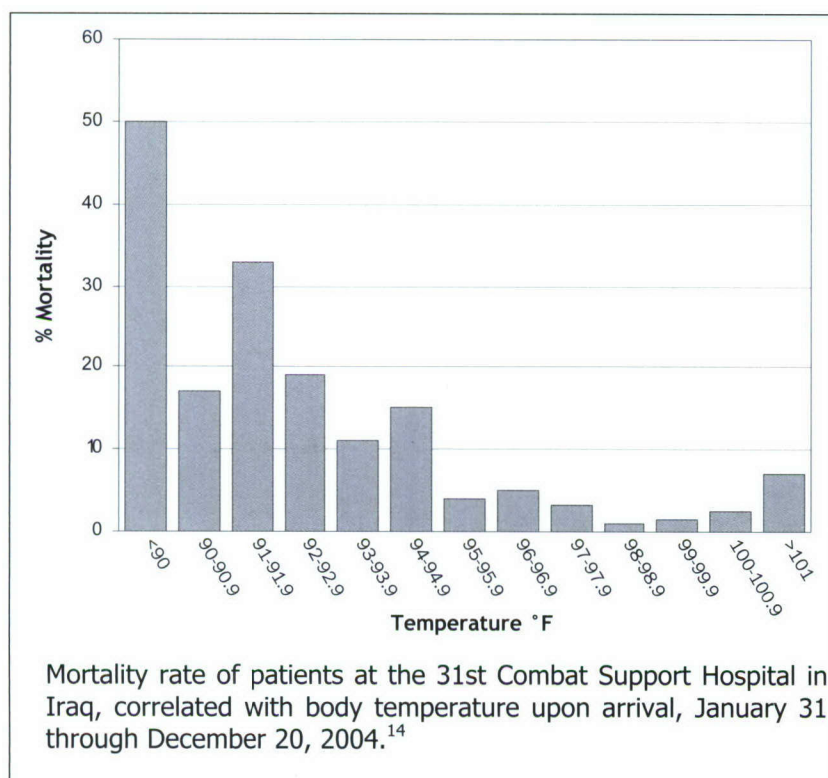
Trauma related hypothermia is defined by body core temperature below 36°C. Hypothermia in trauma and

surgery patients (especially below 34°C) is an independent risk factor and marker of mortality.<sup>3-7</sup> The isolated brain injury patients are the one group that you must be careful rewarming. They should not be rapidly rewarmed above a normal temperature. The major pathophysiologic mechanism associated with trauma and hypothermia related mortality is an exacerbation of coagulopathy and platelet dysfunction, as well as other life threatening complications including infection, electrolyte disturbances, and cardiac dysrhythmias.<sup>8-10</sup> Studies of civilian patients requiring damage control surgery who presented with hypothermia that was subsequently treated with rewarming demonstrated decreased mortality as well as decreased blood and intravenous fluid requirements.<sup>11-13</sup> In a trauma registry of trauma patients

evaluated at a Combat Support Hospital (CSH) during Operation Iraqi Freedom, mortality was also found to be independently associated with admission hypothermia (temperatures below 36°C).<sup>14</sup> That correlation is presented in the Figure.

Patients with admission hypothermia at the CSH in this study also had a significantly higher blood product and factor VIIa requirements. The prevention and correction of hypothermia in damage control patients at FSTs should decrease mortality, as well as the volume of fluid and blood products these patients require. This is especially important in the logistically challenged, austere environment of far-forward combat surgery.

Currently, therapies to prevent and treat hypothermia are not standardized and vary between US Army FSTs and



between the services (ie, US Navy and US Air Force level II surgical facilities). During the development of a joint theater-wide trauma system, the US military has been challenged to:

1. Define the optimal measures to prevent and treat hypothermia at level II surgical facilities.
2. Provide implementation and universal application of these measures at all level II military surgical facilities.

### OPTIONS FOR PREVENTION OF HEAT LOSS AND THERAPIES TO INCREASE CORE BODY TEMPERATURE

Heat loss with decreases in core body temperature is thought to result from one or a combination of 4 mechanisms:

- Radiation
- Evaporation
- Convection
- Conduction

Primary attention should focus on the *prevention* of heat loss since rewarming patients can be difficult and may require active measures which are invasive and limited in the combat environment. Furthermore, once hypothermia has occurred, patients may be subjected to the self-propagating vortex of the lethal triad—hypothermia causes coagulopathy, which then causes more bleeding, which then results in heat loss, which then causes more coagulopathy, which causes more—and the cycle continues.

Options for preventing heat loss and warming surgical patients involves everything that touches or goes into the patient. Since a significant cause for the loss of body temperature is radiation heat loss, the obvious first area of concern is the ambient temperature in the operating room.

### AMBIENT OPERATING ROOM TEMPERATURE

The summer months in Southwest Asia are very warm, the nights and winter however, especially in the desert environment, can be surprisingly cold. Ambient temperatures lower than 80°F in the operating room are associated with the most common cause of heat loss from radiation. Elevating ambient temperature in the operating room to over 80°F is one of the most important measures to prevent heat loss and decreases

in core body temperature in surgical patients.<sup>15-17</sup> Limitations to this simple maneuver include the inability to adequately heat the operating room. However, environmental control units have demonstrated the capability to effectively heat the operating room and postoperative areas and should be widely deployed with the FST whenever feasible.

### INTRAVENOUS BLOOD AND FLUID WARMERS

Damage control procedures are usually associated with the most critically injured patients. In some cases with documented survival, the resuscitative intravenous fluid requirement has exceeded several liters of crystalloid and up to 40 to 50 units of blood and blood products. These large amounts of refrigerated blood and room temperature fluid can have a dramatic effect on decreasing core body temperature. Infusion devices that warm blood and intravenous (IV) fluid before entering the patient have been documented to prevent heat loss and maintain body core temperature.<sup>18,19</sup> Furthermore, use of rapid infusion systems, in addition to fluid warming, has been documented to decrease fluid and blood requirements, preserve body temperature, and decrease acidosis in hypovolemic trauma patients (optimally after surgical hemostasis).<sup>20</sup> The Belmont FMS-2000® (Belmont Instrument Corporation, 780 Boston Road, Billerica, MA 01821) rapid infusion warming device has demonstrated the capability to adequately warm and infuse rapid amounts of blood and IV fluids.<sup>21</sup>

Currently, warming devices are not universally deployed with the FST. Several field expedient and other novel devices have been used to warm IV fluids. These range from warming water baths to immersing the fluids, utilizing the heating element of a meal-ready-to-eat (MRE), hand warmers, coffee makers, and wrapping IV fluids in heat blankets. The temperature of the fluid may be hard to control with these field expedient methods and could result in overheating, so these methods cannot be universally endorsed.

### CONVECTIVE HEAT BLANKETS

Heating blankets prevent radiation heat loss and actively warm patients by convection, blowing air warmed to 44°C through air columns within the blankets. These systems require electricity and a heating air flow generating unit, as well as disposable

## Maximizing Patient Thermoregulation in US Army Forward Surgical Teams

blankets. The requirements can limit its use in the austere environment. Heating blankets are placed strategically over the patient's body areas that are not undergoing the surgical procedure.

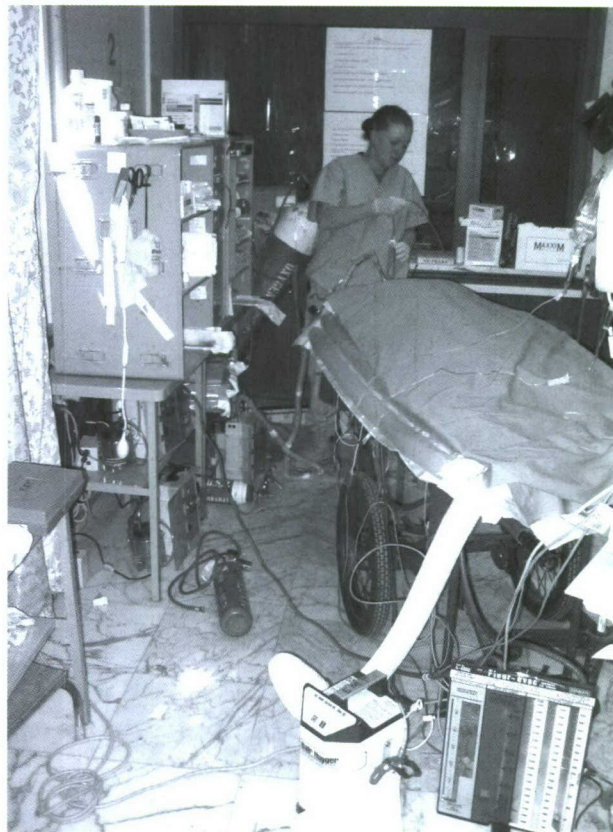
Unfortunately, patients who can benefit the most, polytrauma patients, frequently remain uncovered because several body areas require simultaneous operative intervention to control hemorrhage. The convective heat system most commonly used in military facilities and civilian trauma centers within the United States is the Bair Hugger<sup>®</sup> Blanket (Arizant Healthcare Inc, 10393 West 70th Street, Eden Prairie, MN 55344) system. Used intraoperatively, convective warming devices have been shown to maintain body temperature and avoid hypothermia.<sup>22-25</sup> Despite the logistical limitations, many FSTs use Bair Huggers in the operating room and postoperative recovery areas. The deployment of Bair Huggers or similar convective warming devices should be universal at all level IIb surgical facilities. Modifications to the device to limit size and weight could be made with minimal industry effort.

Conductive heat loss is another important cause of decreased core body temperature in severely injured patients when these patients are placed on cold stretchers, gurneys, or operating room tables. Simple actions such as the placement of wool blankets, sheets, or other materials that conduct less heat can help minimize heat loss.

Hemorrhagic shock and physiologic derangements result in peripheral vasoconstriction to conserve core body temperature. These homeostatic systems are often overwhelmed in the postoperative resuscitative period, resulting in vasodilation and may allow for further potential body temperature loss. This potential for postoperative heat loss further emphasizes the importance of ambient room temperature, convective heating devices, and the avoidance of conductive heat loss in the immediate postoperative period.

### IRRIGATION FLUID

While it is unusual to use copious irrigation fluid for peritoneal washout during the initial abbreviated laparotomy of damage control, many patients also need irrigation of large soft-tissue wounds. Using ambient temperature irrigation fluid can contribute to



Bair Hugger convection blanket in use in the emergency department

hypothermia, while using irrigation fluid warmed close to normal body temperature can help maintain normothermia.<sup>26,27</sup> There are several potential ways to warm irrigation fluid, including the flameless MRE heaters, microwave ovens, or modification of a convective heater.<sup>28-30</sup> For example, in 2002 a convective Bair Hugger heating hose was used to heat a box of IV and irrigation fluids during deployment to the Afghanistan theater.<sup>31</sup> Several other commercially available heating devices for fluids, such as those produced by Entermics Medical Systems (W164 N9221 Water Street, Menomonee Falls, WI 53051), are also available. A standard method for warming irrigation and intravenous fluid should be field-tested for universal use by all FSTs.

Evaporative heat losses are also important. Patients with open abdomen may experience significant heat losses. The abdomen should be protected with water and airtight barriers, such as, Ioban 2<sup>™</sup> (3M, St. Paul, MN 55144-1000) to minimize evaporative heat losses.

## OPTIMAL MEASURES FOR HYPOTHERMIA PREVENTION DURING HELICOPTER EVACUATION

All patients undergoing surgery at the FST or level II facility will be evacuated to the CSH or level III for continuing care and more definitive operative procedures. Intratheater patient movement is usually accomplished by helicopter. Patient movement is associated with environmental exposures, including cooler air at altitude and wind chill.<sup>32</sup> In a study of heat loss during transport in a civilian intensive care unit, patients transported to the radiology department for a computed tomographic scan were found to lose up to 2°C of body temperature.<sup>33</sup> Preventing hypothermia in a postoperative damage control patient in a helicopter is much more challenging than the intrahospital trip to radiology. Air flow through the helicopter should be minimized as much as possible within constraints of security (ie, door gunner). Anecdotal reports indicate that placing the postoperative patient in a "hot pocket" consisting of a modified body bag with 2 wool blankets and a reflective blanket has been used in both Afghanistan and Iraq for retention of body heat. Alternatively, the patient can be placed in a commercially available NARP Hypothermia Prevention and Management Kit™ (HPMK) (North American Rescue Products, Inc, 481 Garlington Road, Suite A, Greenville SC 29615), which includes an active heating element. Some have used the HPMK inside the hot pocket as well. The major limitation of both of these body temperature preservation techniques is that they completely cover the patient, which inhibits patient access and does not allow observation of en route bleeding.

Further evidence to support the technique of multiple layers for transport is that layers of insulating materials have been shown to help decrease loss of body heat in perioperative civilian patients.<sup>34</sup>

While layers of insulating materials decrease loss of body heat, active warming via a convective warming device has been demonstrated to offer optimal prevention of hypothermia in civilian patients



Field expedient "hot pocket"

during transfer.<sup>33</sup> The addition of an active convective heating device (eg, Bair Hugger, Thermal Angel® [Estill Medical Technologies, Inc, 4144 N Central Expressway, Suite 260, Dallas, TX 75204]) and layers of insulating materials may offer the optimal hypothermia prevention to patients undergoing helicopter evacuation. Helicopter safety testing and subsequent fielding of a convective heating system to every helicopter evacuation platform should be considered.

## OPTIMAL ANESTHESIA FOR THERMOREGULATION

General volatile anesthetics (ie, gas anesthetics) further exacerbate hypothermia in trauma patients by loss of normal thermoregulatory vasoconstriction with resultant vasodilation and redistribution of heat to the skin and peripheral tissues.<sup>35,36</sup> One technique to avoid anesthetic-related hypothermia may be the use of TIVA (total intravenous anesthesia). TIVA, which utilizes intravenous medications such as propofol, ketamine, and fentanyl, with or without a paralytic, may be associated with less peripheral vasodilation and subsequent heat loss.<sup>37,38</sup> TIVA has been used in thousands of civilian patients and has been used by providers in the



Hypothermia Prevention & Management kit

## Maximizing Patient Thermoregulation in US Army Forward Surgical Teams

Iraq theater.<sup>39</sup> One of the authors, LTC Grathwohl, used TIVA anesthesia for combat penetrating neurological injury in over 125 patients, demonstrating the safety and effectiveness of its use in the austere environment.

TIVA should be considered for use in the majority of patients undergoing damage control surgery at FSTs.

### UNIVERSAL LEVEL IIB SUGGESTIONS

Suggestions for consideration for creating universal thermoregulatory measures for Level IIB are listed in the Table. We believe these measures will help decrease the morbidity and mortality of damage control patients, and decrease the logistic requirements for each individual patient.

### FUTURE MEASURES FOR FST THERMOREGULATION

Currently, far-forward deployed ventilators have no ability to heat ventilator gases. Warming of ventilator gases has been documented to help conserve body core temperature.<sup>40</sup> Humidifier moisture exchangers have also been demonstrated to prevent further respiratory related heat loss. Future research and acquisition of these specialized ventilators could help maintain body temperature in the future.

A clear plastic hot pocket with multiple access points would allow patient observation and access en route, similar to the commercially available nuclear, biological, and chemical contamination patient covers. Improvements in convective warming devices, including water-warmed body/bed pads, may represent optimal body warming and replace warm air convective devices in the future.<sup>41</sup> The Arctic Sun is another proprietary device that has demonstrated promise in improving the ability to rapidly warm patients. Some civilian trauma centers are using the fluid rapid infusion device with adaptation to an arterial-venous blood warming device in patients with severe hypothermia. This may have future application in the far-forward surgical platforms and level III surgical facilities.<sup>11</sup>

Looking at long-term advances to provide noninvasive, deep tissue warming using currently unknown technology will provide rapid total body warming to any desired temperature. While, at first

glance, one might conjure images of a science fiction movie, this technology may include advances in microwave heating or other deep radiating heat sources. This could conceivably include regional temperature gradients, for example, providing brain cooling and truncal heating in the multiple system injured patient. While this technology is probably far in the future, the US military should provide leadership in its development.

Recommended Standard Thermoregulatory Equipment for Level IIB Surgical Facilities	
Item	Quantity
Bair Hugger warming unit	4
Bair Hugger convection blanket	20
Belmont FMS-2000 fluid warmer	3
Belmont FMS-2000 tubing	20
Body bags	10
Wool blankets	20
Reflective blankets	10
Environmental Control Unit	2
Enthermic Medical Systems fluid warmer	1
Total Intravenous Anesthesia infusion pump	2

### CONCLUSION

Creating universal minimal thermoregulation standards for all FSTs may decrease morbidity and mortality of combat damage control patients. These standards will also decrease the blood and IV fluid requirements for each individual patient, decreasing the logistical challenges for the FSTs. The importance of maintaining body core temperature in these combat damage control surgery patients cannot be overemphasized.

### REFERENCES

1. Rotondo MF, Bard MR. Damage control surgery for thoracic injuries. *Injury*. 2004;35(7):649-654.
2. De Waele JJ, Vermassen FE. Coagulopathy, hypothermia and acidosis in trauma patients: the rationale for damage control surgery. *Acta Chir Belg*. 2002;102(5):313-316.

3. Asensio JA, McDuffie L, Petrone P, et al. Reliable variables in the exsanguinated patient which indicate damage control and predict outcome. *Am J Surg.* 2001;182(6):743-751.
4. Tyburski JG, Wilson RF, Dente C, Steffes C, Carlin AM. Factors affecting mortality rates in patients with abdominal vascular injuries. *J Trauma.* 2001;50(6):1020-1026.
5. Cushman JG, Feliciano DV, Renz BM, et al. Iliac vessel injury: operative physiology related to outcome. *J Trauma.* 1997;42(6):1033-1040.
6. Hoyt DB, Bulger EM, Knudson MM, et al. Death in the operating room: an analysis of a multicenter experience. *J Trauma.* 1994;37(3):426-432.
7. Janczyk RJ, Howells GA, Bair HA, Huang R, Bendick PJ, Zelenock GB. Hypothermia is an independent predictor of mortality in ruptured abdominal aortic aneurysms. *Vasc Endovasc Surg.* 2004;38(1):37-42.
8. Martini W, Pusateri A, Uscilwicz J, Delgado A, Holcomb J. Independent contributions of hypothermia and acidosis to coagulopathy in swine. *J Trauma.* 2005;58:1002-1010.
9. Cosgriff N, Moore EE, Sauaia A, Kenny-Moynihan M, Burch JM, Galloway B. Predicting life-threatening coagulopathy in the massively transfused trauma patient: hypothermia and acidosis revisited. *J Trauma.* 1997;42(5):857-861.
10. Ferrara A, MacArthur JD, Wright HK, Modlin IM, McMillen MA. Hypothermia and acidosis worsen coagulopathy in the patient requiring massive transfusion. *Am J Surg.* 1990;160(5):515-518.
11. Gentilello LM, Jurkovich GJ, Stark MS, Hassantash SA, O'Keefe GE. Is hypothermia in the victim of major trauma protective or harmful? A randomized, prospective study. *Ann Surg.* 1997;226(4):439-447.
12. Johnson JW, Gracias VH, Schwab CW, et al. Evolution in damage control for exsanguinating penetrating abdominal injury. *J Trauma.* 2001;51(2):261-269.
13. Bernabei AF, Levison MA, Bender JS. The effects of hypothermia and injury severity on blood loss during trauma laparotomy. *J Trauma.* 1992;33(6):835-839.
14. Arthurs Z, Cuadrado D, Beekley A, et al. The impact of hypothermia on trauma care at the 31st Combat Support Hospital. *Am J Surg.* 2006;191(5):610-614.
15. Macario A, Dexter F. What are the most important risk factors for a patient's developing intraoperative hypothermia? *Anesth Analg.* 2002;94(1):215-220.
16. Kean M. A patient temperature audit within a theatre recovery unit. *Br J Nurs.* 2000;9(3):150-156.
17. Closs SJ, Macdonald IA, Hawthorn PJ. Factors affecting perioperative body temperature. *J Adv Nurs.* 1986;11(6):739-744.
18. Smith CE, Desai R, Glorioso V, Cooper A, Pinchak AC, Hagen KF. Preventing hypothermia: convective and intravenous fluid warming versus convective warming alone. *J Clin Anesth.* 1998;10(5):380-385.
19. Smith CE, Gerdes E, Sweda S, et al. Warming intravenous fluids reduces perioperative hypothermia in women undergoing ambulatory gynecological surgery. *Anesth Analg.* 1998;87(1):37-41.
20. Dunham CM, Belzberg H, Lyles R. The rapid infusion system: a superior method for the resuscitation of hypovolemic trauma patients. *Resuscitation.* 1991;21(2-3):207-227.
21. Dubick MA, Brooks DE, Macaitis JM, Bice TG, Moreau AR, Holcomb JB. Evaluation of commercially available fluid-warming devices for use in forward surgical and combat areas. *Mil Med.* 2005;170(1):76-82.
22. Cassey J, Strezov V, Armstrong P, et al. Influence of control variables on mannequin temperature in a paediatric operating theatre. *Paediatr Anaesth.* 2004;14(2):130-134.
23. Kober A, Scheck T, Fulesdi B, et al. Effectiveness of resistive heating compared with passive warming in treating hypothermia associated with minor trauma: a randomized trial. *Mayo Clin Proc.* 2001;76(4):369-375.
24. Patel N, Smith CE, Knapke D, Pinchak AC, Hagen JF. Heat conservation vs convective warming in adults undergoing elective surgery. *Can J Anaesth.* 1997;44(6):669-673.
25. Borms SF, Engelen SL, Himpe DG, Suy MR, Theunissen WJ. Bair Hugger forced-air warming maintains normothermia more effectively than thermolite insulation. *J Clin Anesth.* 1994;6(4):303-307.
26. Moore SS, Green CR, Wang FL, Pandit SK, Hurd WW. The role of irrigation in the development of hypothermia during laparoscopic surgery. *Am J Obstet Gynecol.* 1997;176(3):598-602.
27. Pit MJ, Tegelaar RJ, Venema PL. Isothermic irrigation during transurethral resection of the prostate: effects on perioperative hypothermia, blood loss, resection time and patient satisfaction. *Br J Urol.* 1996;78(1):99-103.

## Maximizing Patient Thermoregulation in US Army Forward Surgical Teams

28. Leaman PL, Martyak GG. Microwave warming of resuscitation fluids. *Ann Emerg Med.* 1985;14(9):876-879.
29. Anshus JS, Endahl GL, Mottley JL. Microwave heating of intravenous fluids. *Am J Emerg Med.* 1985;3(4):316-319.
30. Garcia GD, Modesto VL, Lee KT. Avoiding hypothermia in trauma: use of the flameless heater pack, meal ready to eat, as a field-expedient means of warming crystalloid fluid. *Mil Med.* 2000;165(12):903-904.
31. Craig R, Peoples GE. A novel device developed, tested, and used for warming and maintaining intravenous fluids in a forward surgical team during Operation Enduring Freedom. *Mil Med.* 2006;171(6):500-503.
32. Beekley AC, Watts DM. Combat trauma experience with the United States Army 102nd Forward Surgical Team in Afghanistan. *Am J Surg.* 2004;187(5):652-654.
33. Scheck T, Kober A, Bertalanffy P, et al. Active warming of critically ill trauma patients during intrahospital transfer: a prospective, randomized trial. *Wien Klin Wochenschr.* 2004;116(3):94-97.
34. Brauer A, Perl T, Uyanik Z, English MJ, Weyland W, Braun U. Perioperative thermal insulation: minimal clinically important differences? *Br J Anaesth.* 2004;92(6):836-840.
35. Nebbia SP, Bissonnette B, Sessler DI. Enflurane decreases the threshold for vasoconstriction more than isoflurane or halothane. *Anesth Analg.* 1996;83(3):595-599.
36. Matsukawa T, Sessler DI, Sessler AM, et al. Heat flow and distribution during induction of general anesthesia. *Anesthesiology.* 1995;82:662-673.
37. Shorrab AA, Atallah MM. Total intravenous anaesthesia with ketamine-midazolam versus halothane-nitrous oxide-oxygen anaesthesia for prolonged abdominal surgery. *Eur J Anaesthesiol.* 2003;20(11):925-931.
38. Ikeda T, Kazama T, Sessler DI, et al. Induction of anesthesia with ketamine reduces the magnitude of redistribution hypothermia. *Anesth Analg.* 2001;93:934-938.
39. Matsuki A, Ishihara H, Kotani N, et al. A clinical study of total intravenous anesthesia by using mainly propofol, fentanyl and ketamine with special reference to its safety based on 26,079 cases. *Anesth Resus.* 2002;51(12):1336-1342.
40. Ginsberg S, Solina A, Papp D, et al. A prospective comparison of three heat preservation methods for patients undergoing hypothermic cardiopulmonary bypass. *J Cardiothorac Vasc Anesth.* 2000;14(5):501-505.
41. Janicki PK, Higgins MS, Janssen J, Johnson RF, Beattie C. Comparison of two different temperature maintenance strategies during open abdominal surgery: upper body forced-air warming versus whole body water garment. *Anesthesiology.* 2001;95(4):868-874.

---

### AUTHORS

LTC(P) Blackburne is Chief, Trauma Service, at the Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

LTC Kurt Grathwohl is the Chief of Anesthesia Critical Care, Brooke Army Medical Center, Fort Sam Houston, Texas, and Medical Director, Surgical Critical Care Consultant to the Army Surgeon General.

LTC Barras is the Assistant Chief Nurse Anesthetist, Womack Army Medical Center, Fort Bragg, North Carolina.

COL Eastridge is the Program Director, Surgical Critical Care, US Army Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.



# Defining Combat Damage Control Surgery

LTC(P) Lorne H. Blackbourne, MC, USA

## WHAT IS COMBAT DAMAGE CONTROL SURGERY?

While civilian damage control surgery has been widely defined, damage control surgery on the battlefield (combat damage control surgery) has not. To define combat damage control, it is imperative to first define the philosophy of damage control surgery, and then describe the current system for damage control in civilian trauma centers. Combat damage control surgery (as it is currently being employed in Operations Iraqi Freedom and Enduring Freedom) can then be defined in contrast. Needless to say, performing damage control surgery in a combat zone has many pitfalls and challenges, and it has even been described as an almost impossible task.<sup>1-3</sup> Nonetheless, aggressive damage control surgery has been, is currently, and will be carried out successfully by combat surgical teams.<sup>4-7</sup>

Combat damage control consists of many stages due to the multiple evacuations involved in moving combat injured US military personnel from the battlefield to, ultimately, the continental United States. Figure 1 provides an overview of such evacuation through the different levels of military medical care.<sup>8</sup>

With the unique requirement for intratheater and global evacuation arises the similarly unique requirement for a modified, multistaged damage control surgical approach.

Our goal is to define combat damage control and its many stages so as to provide a platform for analysis of our current capabilities. We must challenge the current situation to allow for maximum improvement at each stage in

military combat damage control, in both current and any future conflicts.

If one looks at the statistics of military personnel who were wounded in combat and died of those wounds after arrival at a surgical facility, then subtracts the numbers for severe head injuries (approximately 15% high-mortality) and all extremity wounds (approximately 55% of combat wounds, low-mortality), one must conclude that improvement of the mortality of damage control patients is the only way to significantly decrease the overall mortality rate of combat wounded in the near future.<sup>9,10</sup>

Acidosis, hypothermia, and coagulopathy following damage control surgery have been documented as predictive of mortality.<sup>11</sup> Therefore, it is only logical to conclude that, in order to decrease the rate of mortality of damage control patients (and the overall mortality rate of wounded reaching surgical facilities), the ability of far forward surgical teams to stop bleeding, stop gastrointestinal soilage, warm, resuscitate, and correct coagulopathy must be optimized, and these gains maintained throughout evacuation.

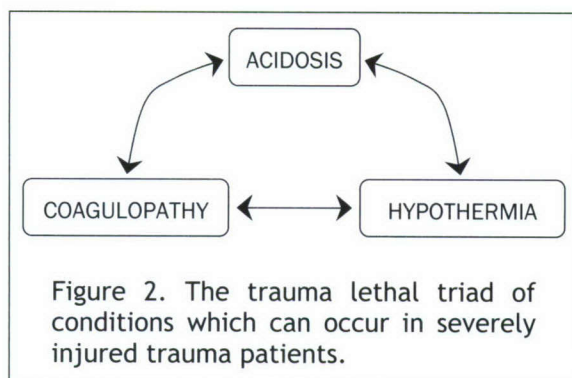
## DAMAGE CONTROL SURGERY

Damage control surgery is a medical parallel to the US Navy discipline focused on "the capacity of a ship to absorb damage and maintain mission integrity."<sup>12</sup> When a Navy ship has taken hostile fire—that is, has been wounded—the sailors, at all costs and as fast as possible, immediately put out all fires and stop any flooding. The surgical analogy is to stop all hemorrhaging and gastrointestinal soilage as fast as possible.



## Defining Combat Damage Control Surgery

The need for speed in obtaining these goals in severely injured trauma patients is the avoidance of the trauma “lethal triad.” The lethal triad is the vicious cycle of hypothermia, acidosis, and coagulopathy.<sup>13</sup> The acidosis is from hypovolemic shock and inadequate tissue perfusion.<sup>14</sup> Hypothermia is from exsanguinations and loss of intrinsic thermoregulation.<sup>15,16</sup> Coagulopathy is from hypothermia, acidosis, consumption of clotting factors/platelets, and blood loss.<sup>17-20</sup> Coagulopathy, in turn, causes more hemorrhage, and thus causes more acidosis and hypothermia; so the “bloody vicious cycle” continues as illustrated by Figure 2. When in full fruition, the vicious cycle of the lethal triad is almost uniformly fatal.



In a landmark paper in 1993, Rotondo et al<sup>21</sup> reported the successful use of an abbreviated operation in trauma patients to avoid the lethal triad, and coined the phrase “damage control” with a mortality of 50% (prior to using this approach these were near universally fatal injuries). Many trauma centers have reported similarly successful results using the damage control approach to the severely injured trauma patient, and it is now considered the standard of care.<sup>22-28</sup>

While originally reported as an approach to severe abdominal trauma, the damage control process has evolved to cover all anatomic regions, including thoracic trauma, neurologic trauma, urologic trauma, and extremity trauma. The damage control process is especially applicable in the multiple system injured trauma patient.<sup>29-36</sup>

### CIVILIAN DAMAGE CONTROL SURGERY

Civilian damage control surgery is now well established as the standard of care for severely injured

patients in the United States. The civilian damage control paradigm is based on the following “damage control trilogy”<sup>37,38</sup>:

### OPERATING ROOM

#### ABBREVIATED SURGICAL OPERATION

Stop all surgical hemorrhage and, secondarily, stop all gastrointestinal succus soilage *in the shortest time possible*.



### INTENSIVE CARE UNIT

#### ICU RESUSCITATION

Administer packed red blood cells, fresh frozen plasma, and platelets as needed using the tenets of damage control resuscitation limiting crystalloid fluids.<sup>39,40</sup> The patient is rewarmed and full laboratory analysis is undertaken with the basic goal of “normalizing” the patient.<sup>41</sup>

When the patient is determined to be hemodynamically stable with lab values, ventilator status, and body temperature in close proximity to “normal,” the patient is then returned to the operating room for the definitive operation.



### OPERATING ROOM

#### DEFINITIVE OPERATION

This second operative procedure most often occurs 24 to 36 hours after the initial operation. The definitive operation would include bowel anastomoses or colostomy maturation, definitive vascular repair where an interposition vascular shunt had been previously placed, removal of hemostatic packing and closure of abdominal fascia where feasible. The patient is then taken back to the intensive care unit (ICU) and the postoperative care progresses towards the ultimate goal of discharge to home or rehabilitation center.

# THE ARMY MEDICAL DEPARTMENT JOURNAL

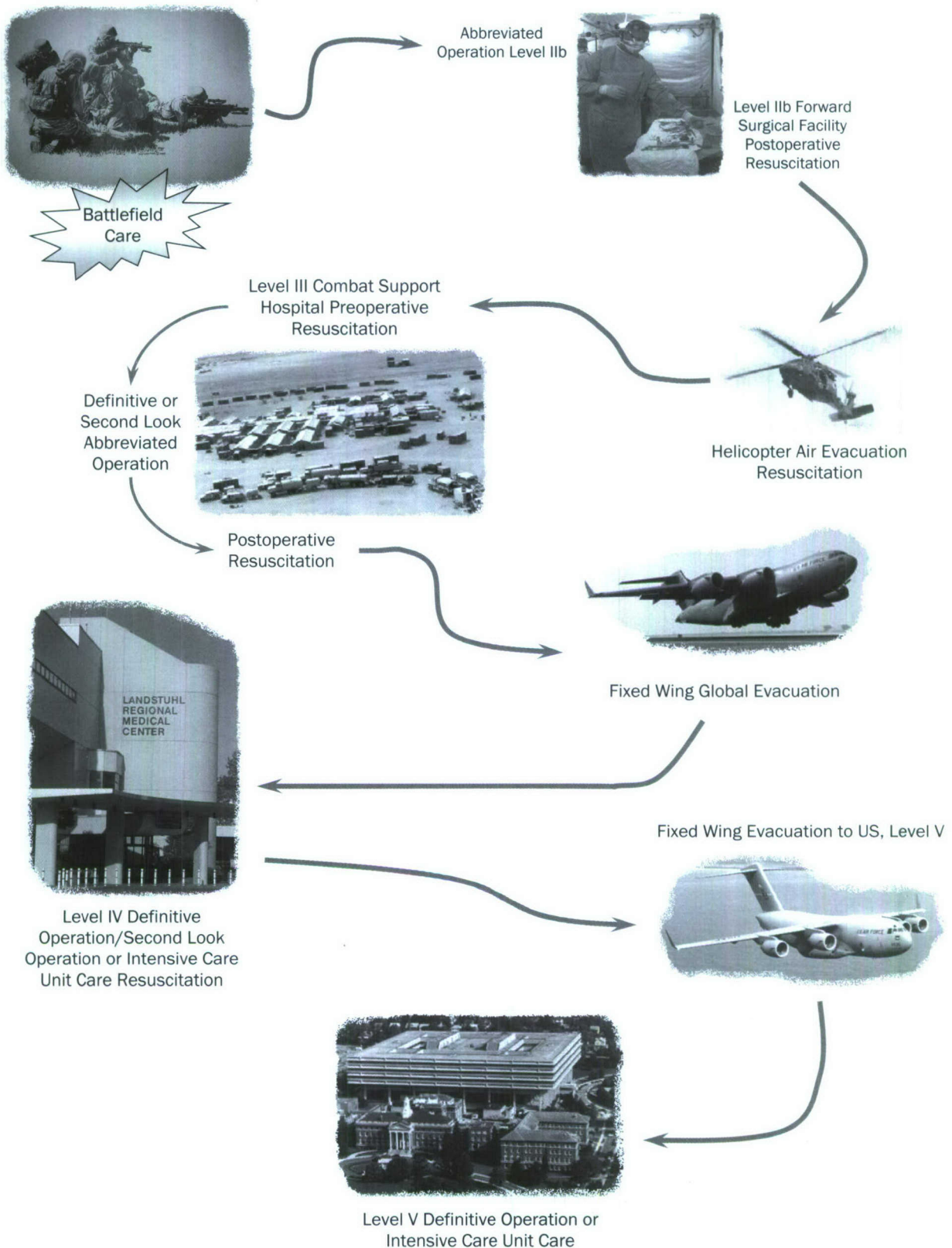


Figure 3. The basic outline of the multiple necessary stages of combat damage control surgery.

## Defining Combat Damage Control Surgery

Each patient undergoing these operative procedures and ICU care require significant personnel and logistics resources.

The documented mortality for the damage control approach to patients requiring a damage control laparotomy is approximately 50% with a documented morbidity of approximately 40%.<sup>42</sup>

In review, the civilian level I trauma center damage control model involves the damage control trilogy—abbreviated operation, ICU resuscitation, and definitive operation—all in the same surgical facility. Military combat damage control surgery does not have the luxury of performing all stages of damage control surgery in a single facility, as the patient undergoes global evacuation and stops at several military surgical facilities.

### US MILITARY DAMAGE CONTROL SURGERY

In stark contrast to the civilian damage control surgery trilogy, combat damage control involves up to 10 stages to allow for battlefield evacuation, surgical operations, and resuscitations. Figure 3 portrays the basic outline for the multiple necessary stages in combat damage control. In comparison to civilian damage control, the most notable difference is the process of resuscitation. Combat damage control postoperative resuscitation and rewarming occurs in several facilities and multiple times during en route air evacuation during the combat damage control process.

### CONCLUSION

Combat damage control is a unique enterprise. As illustrated in Figure 4, while civilian damage control surgery can be described as a simple trilogy in *one* hospital, combat damage control surgery undertakes many stages and involves multiple facilities as the patient undergoes global evacuation.

To improve combat damage control surgery, we must first define the stages, and then assess the personnel, logistics, techniques, complications, unique challenges, and outcomes of each stage. Only then can areas for improvement be *defined by stage*, and patient care optimized.

Combat damage control is an amazing and very unique process. The successful recovery, care, and transport of a severely injured Soldier from the battlefield to medical centers in the United States is an extremely challenging undertaking. All military personnel involved in combat damage control surgery should be justifiably proud—and yet always striving to improve further.

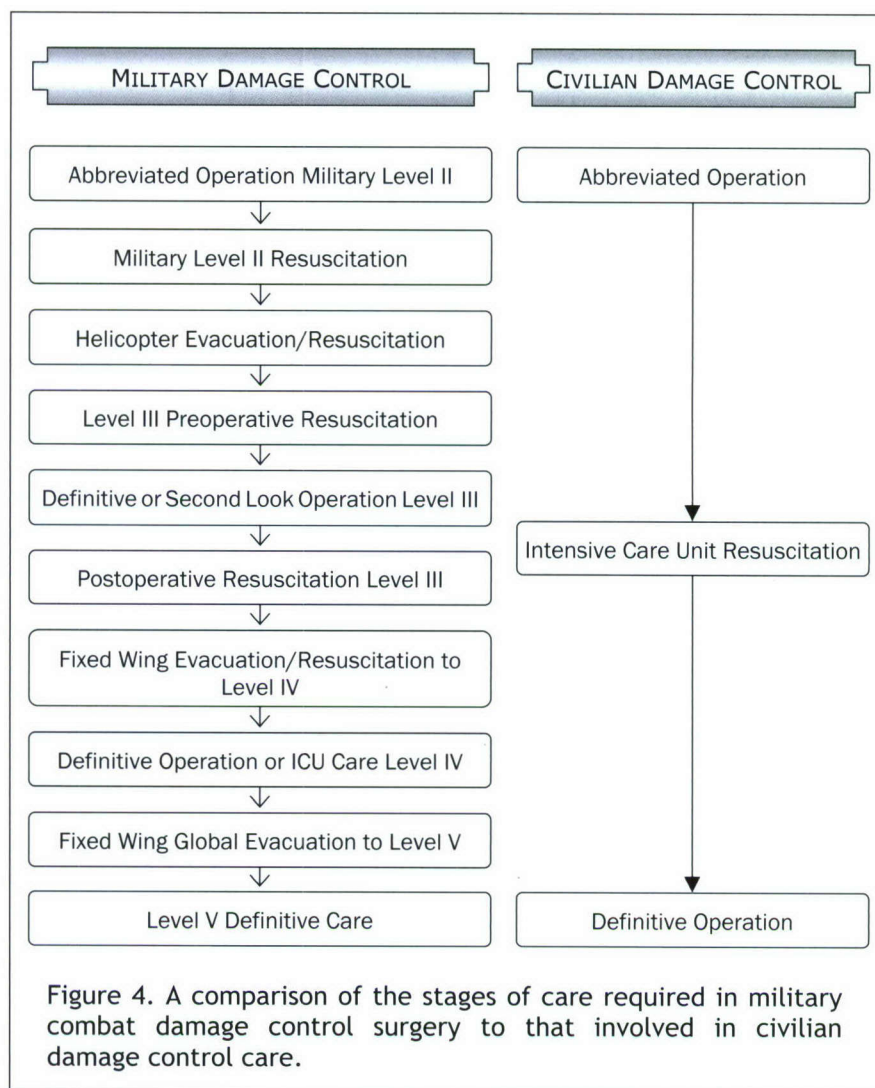


Figure 4. A comparison of the stages of care required in military combat damage control surgery to that involved in civilian damage control care.



## REFERENCES

1. Eiseman B, Moore F, Meldrum D, Raeburn C. Feasibility of damage control surgery in the management of military combat casualties. *Arch Surg.* 2000;135(11):1323-1327.
2. Leppaniemi AK. Abdominal war wounds--experiences from Red Cross field hospitals. *World J Surg.* 2005;29(suppl):S67-S71.
3. Neuhaus SJ, Bessell JR. Damage control laparotomy in the Australian military. *ANZ J Surg.* 2004;74(1-2):18-22.
4. Chambers L, Rhee P, Baker B, et al. Initial experience of US Marine Corps forward resuscitative surgical system during Operation Iraqi Freedom. *Arch Surg.* 2005;140(1):26-32.
5. Beekley A, Watts D. Combat trauma experience with the United States Army 102nd Forward Surgical Team in Afghanistan. *Am J Surg.* 2004;187(5):652-654.
6. Burris D, Fitzharris J, Holcomb J, et al, eds. *Emergency War Surgery*. 3rd ed. Washington, DC: Borden Institute, Office of the Surgeon General, US Dept of the Army; 2004.
7. Bellamy, R. The causes of death in conventional land warfare: implications for combat casualty care research. *Mil Med.* 1984;149(2):55-62.
8. Mabry RL, Holcomb JB, Baker AM, et al. United States Army Rangers in Somalia: an analysis of combat casualties on an urban battlefield. *J Trauma.* 2000;49(3):515-529.
9. Aoki N, Wall MJ, Demsar J, et al. Predictive model for survival at the conclusion of a damage control laparotomy. *Am J Surg.* 2000;180(6):540-545.
10. *Surface ship survivability*. Naval Warfare Publications 3-20.31. Washington, DC: US Dept of the Navy; January 2004.
11. Parr MJ, Alabdi T. Damage control surgery and intensive care. *Injury.* 2004;35(7):713-722.
12. De Waele JJ, Vermassen FE. Coagulopathy, hypothermia and acidosis in trauma patients: the rationale for damage control surgery. *Acta Chir Belg.* 2002;102(5):313-316.
13. Eddy VA, Morris JA Jr, Cullinane DC. Hypothermia, coagulopathy, and acidosis. *Surg Clin North Am.* 2000;80(3):845-854.
14. Tsuei BJ, Kearney PA. Hypothermia in the trauma patient. *Injury.* 2004;35(1):7-15.
15. Martini W, Pusateri A, Uscilwicz J, Delgado A, Holcomb J. Independent contributions of hypothermia and acidosis to coagulopathy in swine. *J Trauma.* 2005;58:1002-1010.

## Defining Combat Damage Control Surgery

16. Armand R, Hess JR. Treating coagulopathy in trauma patients. *Transfus Med Rev*. 2003;17(3):223-231.
17. Cosgriff N, Moore EE, Sauaia A, Kenny-Moynihan M, Burch JM, Galloway B. Predicting life-threatening coagulopathy in the massively transfused trauma patient: hypothermia and acidosis revisited. *J Trauma*. 1997;42(5):857-861.
18. Ferrara A, MacArthur JD, Wright HK, Modlin IM, McMillen MA. Hypothermia and acidosis worsen coagulopathy in the patient requiring massive transfusion. *Am J Surg*. 1990;160(5):515-518.
19. Rotondo MF, Schwab CW, McGonigal MD, et al. "Damage control": an approach for improved survival in exsanguinating penetrating abdominal injury. *J Trauma*. 1993;35:375-383.
20. Loveland JA, Boffard KD. Damage control in the abdomen and beyond. *Br J Surg*. 2004;91(9):1095-1101.
21. Kouraklis G, Spirakos S, Glinavou A. Damage control surgery: an alternative approach for the management of critically injured patients. *Surg Today*. 2002;32(3):195-202.
22. Hirshberg A, Mattox KL. Planned reoperation for severe trauma. *Ann Surg*. 1995;222(1):3-8.
23. Burch J, Ortiz V, Richardson R, Martin R, Mattox K, Jordan G. Abbreviated laparotomy and planned reoperation for critically injured patients. *Ann Surg*. 1992;215(5):476-484.
24. Sharp KW, Locicero RJ. Abdominal packing for surgically uncontrollable hemorrhage. *Ann Surg*. 1992;215(5):467-475.
25. Burch JM, Ortiz VB, Richardson RJ, Martin RR, Mattox KL, Jordan GL Jr. Abbreviated laparotomy and planned reoperation for critically injured patients. *Ann Surg*. 1992;215(5):476-483.
26. Johnson JW, Gracias VH, Schwab CW, et al. Evolution in damage control for exsanguinating penetrating abdominal injury. *J Trauma*. 2001;51:261-271.
27. Roberts C, Pape H, Jones A, Malkani A, Rodriguez J, Giannoudis P. Damage control orthopaedics: evolving concepts in the treatment of patients who have sustained orthopaedic trauma. *Instr Course Lect*. 2005;54:447-462.
28. Rotondo MF, Bard MR. Damage control surgery for thoracic injuries. *Injury*. 2004;35(7):649-654.
29. Rosenfeld JV. Damage control neurosurgery. *Injury*. 2004;35(7):655-660.
30. Hildebrand F, Giannoudis P, Krettek C, Pape HC. Damage control: extremities. *Injury*. 2004;35(7):678-689.
31. Moore EE, Thomas G. Orr Memorial Lecture. Staged laparotomy for the hypothermia, acidosis, and coagulopathy syndrome. *Am J Surg*. 1996;172(5):405-410.
32. Harwood PJ, Giannoudis PV, van Griensven M, Krettek C, Pape HC. Alterations in the systemic inflammatory response after early total care and damage control procedures for femoral shaft fracture in severely injured patients. *J Trauma*. 2005;58(3):446-452.
33. Wall MJ Jr, Villavicencio RT, Miller CC III, et al. Pulmonary tractotomy as an abbreviated thoracotomy technique. *J Trauma*. 1998;45(6):1015-1023.
34. Mashiko K, Matsumoto H, Mochizuki T, Takuhiro K, Hara Y, Katada S. Damage control for thoracic injuries. *Nippon Geka Gakkai Zasshi*. 2002;103(7):511-516.
35. Caceres M, Buechter KJ, Tillou A, Shih JA, Liu D, Steeb G. Thoracic packing for uncontrolled bleeding in penetrating thoracic injuries. *South Med J*. 2004;97(7):637-641.
36. Shapiro M, Jenkins D, Schwab CW, et al. Damage control: collective review. *J Trauma*. 2000;49:969-978.
37. Kouraklis G, Spirakos S, Glinavou A. Damage control surgery: an alternative approach for the management of critically injured patients. *Surg Today*. 2002;32(3):195-202.
38. Parr MJ, Alabdi T. Damage control surgery and intensive care. *Injury*. 2004;35(7):713-722.
39. Spahn DR, Rossaint R. Coagulopathy and blood component transfusion in trauma. *Br J Anaesth*. 2005;95(2):130-139. Available at: <http://bj.a.oxfordjournals.org/cgi/content/full/95/2/130>.
40. Moore E, Feliciano D, Mattox K. *Trauma*. 5th ed. New York, NY: McGraw-Hill Professional Publishing; 2004.
41. Bashir MM, Abu-Zidan FM. Damage control surgery for abdominal trauma. *Eur J Surg*. 2002;suppl 588:8-13.

## AUTHOR

LTC(P) Blackbourne is Chief, Trauma Service, at the Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, Texas.

## **SUBMISSION OF ARTICLES TO THE *ARMY MEDICAL DEPARTMENT JOURNAL***

The *AMEDD Journal* is published quarterly to expand knowledge of domestic and international military medical issues and technological advances; promote collaborative partnerships among the Services, components, Corps, and specialties; convey clinical and health service support information; and provide a professional, high quality, peer reviewed print medium to encourage dialogue concerning health care issues and initiatives.

### **REVIEW POLICY**

All manuscripts will be reviewed by the *AMEDD Journal*'s Editorial Board and, if required, forwarded to the appropriate subject matter expert for further review and assessment.

### **GUIDELINES FOR MANUSCRIPT SUBMISSIONS**

1. Articles should be submitted in digital format (preferably an MS<sup>®</sup> Word document on CD or floppy disk) with one printed copy of the manuscript. Ideally, a manuscript should be no longer than 24 double-spaced pages. However, exceptions will always be considered on a case-by-case basis. In general, 4 double-spaced MS Word pages produce a single page of 2 column text in the *AMEDD Journal* production format.
2. The *American Medical Association Manual of Style* governs formatting in the preparation of text and references. All articles should conform to those guidelines as closely as possible. Use of abbreviations should be limited as much as possible. Inclusion of a list of article acronyms and abbreviations can be very helpful in the review process and is strongly encouraged.
3. A complete list of references cited in the article must be provided with the manuscript. The following is a synopsis of the American Medical Association reference format:
  - References to published articles will include the authors' surnames and initials, article title, publication title, year of publication, volume, and page numbers.
  - References to books will include the authors' surnames and initials, book title, volume and/or edition if appropriate, place of publication, publisher, year of copyright, and specific page numbers if cited.
  - References to presentations, unpublished papers, conferences, symposia, etc., will include as much identifying information as possible (location, dates, presenters, sponsors, titles).
4. Either color or black and white photographs may be submitted with the manuscript. Color produces the best print reproduction quality, but please avoid excessive use of multiple colors and shading. Space limitations normally restrict photos to a maximum of eight per manuscript. Digital graphic formats (JPG, GIF, BMP) and MS Word photo files are preferred. Prints of photographs are acceptable. Please do not send photos embedded in PowerPoint. Images submitted on slides, negatives, or copies of X-ray film will not be published. For clarity, please mark the top of each photographic print on the back. Tape captions to the back of photos or submit them on a separate sheet. Ensure captions and photos are indexed to each other. Clearly indicate the desired position of each photo within the manuscript if not cited in the text.
5. The authors' names, ranks, titles, current unit of assignment, and contact information must be included on the title page of the manuscript.
6. Submit articles to:

COMMANDER  
US ARMY MEDICAL DEPARTMENT CENTER & SCHOOL  
ATTN: MCCS HSA  
2250 STANLEY ROAD STE 0408  
FORT SAM HOUSTON, TX 78234-6150

DSN 471-7326/6301  
Comm 210-221-7326/6301  
Fax: DSN 471-8720 Comm 210-221-8720  
Email: donald.aldridge@amedd.army.mil  
richard.e.burton@amedd.army.mil

